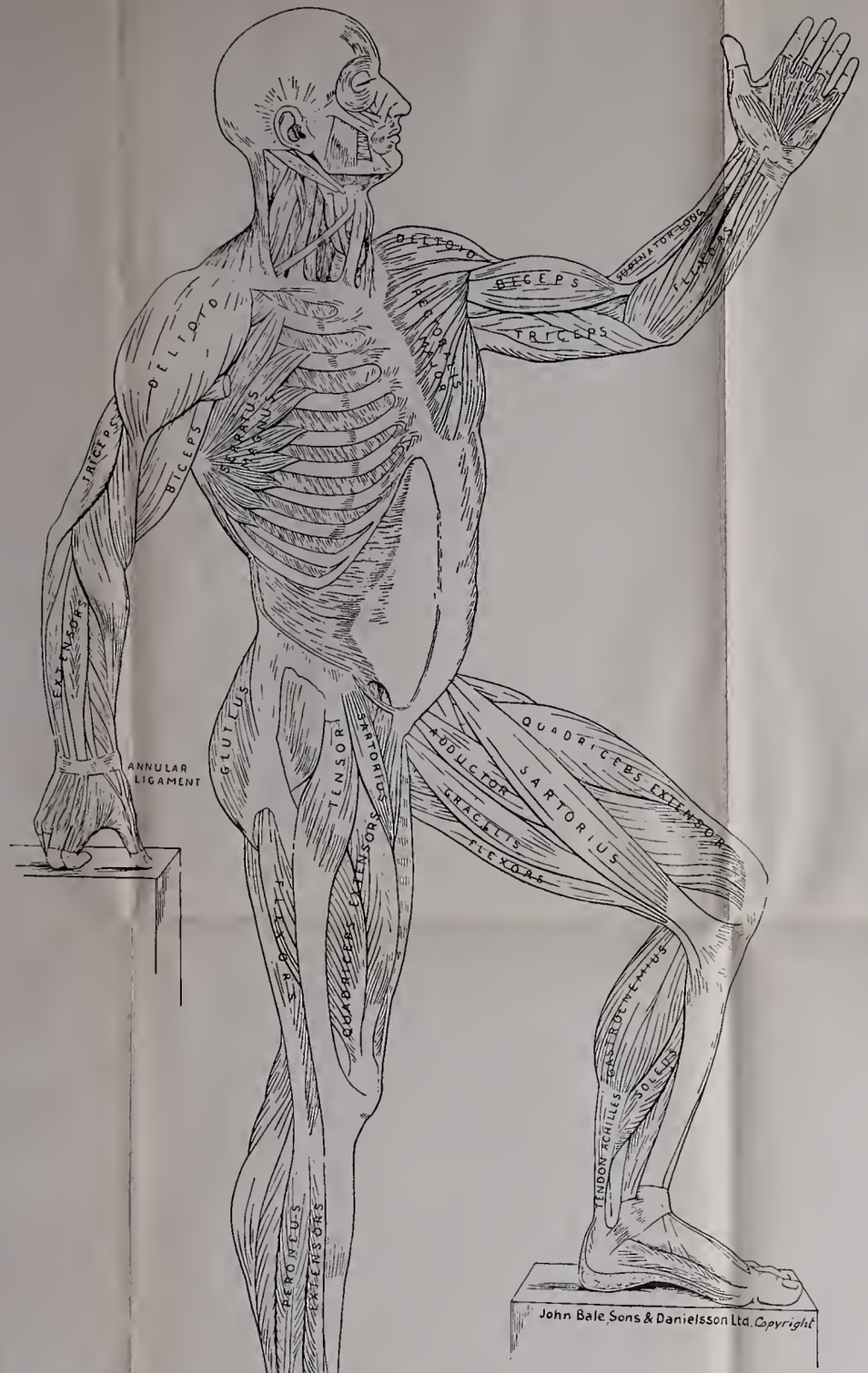
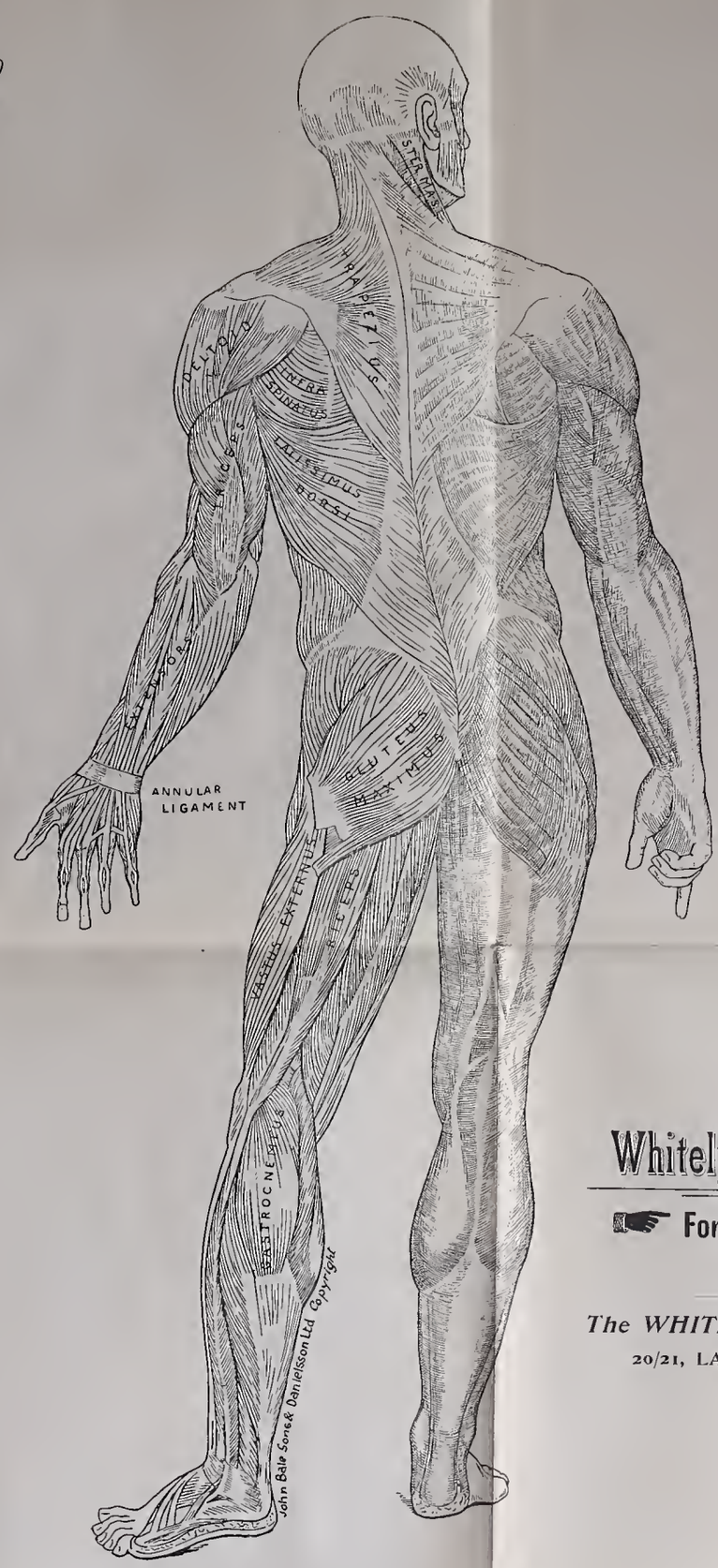
Exercise for Health

its

Science & Practice

(Illustrated)





The

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For Description of Muscles, see Part II.

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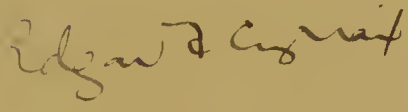

EXERCISE FOR HEALTH.

ITS SCIENCE AND PRACTICE

(IN THREE PARTS).

Containing an Anatomical, Dumb-bell, and other Charts, with full Explanations.

By H. H. HULBERT,

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INTRODUCTORY.

At last, we are pleased to believe the public generally have grasped the fact that for the preservation of health, exercise in some form or other is a necessity, though as to the form this exercise should take there appears to be a very diversified opinion.

The Medical Profession have for some years past recognised the value of muscular movements for the cure of many common ailments, and in the year 1839 there died a distinguished Swede, who, during his life, formulated a very complete system of Medical Gymnastics, which are practised at the present day under the name of the Ling System. Dr. Roth has written an abbreviated account of the system in one of our standard works, the "Dictionary of Surgery," edited by Sir Christopher Heath.

The public, however, through ignorance of their own bodies, are not in a position to realise the enormous amount of good that

can be derived from exercise when it is conducted upon scientific lines.

It is our intention to endeavour, in this manual, to put before our readers both the scientific and practical sides in as simple and clear a manner as is consistent with accuracy, so that they may be enabled to form for themselves correct ideas on the subject by the use of their common sense; and shall therefore content ourselves in bringing forth arguments to substantiate our own case, which we consider to be quite strong enough, without deeply discussing the principles set forth by other teachers. Our chief difficulty will be to keep our subject within reasonable bounds, because its teaching is so interesting and important to everyone.

JANUARY, 1898.

EXERCISE FOR HEALTH.

Part I.

CHAPTER I.

THE BODY AND ITS MACHINERY.

As this is meant to be a purely popular treatise upon the good effects of systematic muscular exercise, we propose to give only such a scant outline of the construction of the body as will be necessary for the public to understand the effect of exercise upon its different organs.

Perhaps the easiest and quickest way of getting an intelligent idea of the workings of the different organs of the human body is to compare it to the working of an ordinary steam engine.

The engine depends for its movement upon the heat given out by the burning of its fuel—the heat converts the water in the boiler into steam, and this drives the piston, which communicates its motion to the wheels. The fuel burns, because it is supplied with oxygen from the air that passes through the furnace; the greater the current of air the more fiercely burns the fuel. Smoke and steam escape

from the engine, and the fuel becomes reduced to ashes.

The engine needs fuel, water, and oxygen; it becomes hot, does its work, and smoke, steam and ashes result from the burning of the fuel.

The human body, like the engine, requires fuel, water, and oxygen; it gets hot by the burning of the fuel by the oxygen, thereby it is enabled to do its work, and waste products result from the burning in the form of carbonic acid gas, water, and urea, which correspond to the smoke, steam, and ashes of the engine.

The fuel, water, and oxygen of the engine must be constantly replenished, and the waste products constantly removed, or the engine will cease to be hot and to do its work. The same applies to the body; it must be constantly supplied with fuel, water, and oxygen, and its waste products constantly removed.

The engine gradually wears away, from the wear and tear of the different parts of its machinery, and, after a time, has to be repaired. The different tissues of the body wear away, but are at once repaired, and in this respect the body proves to be a far more perfect machine than a locomotive.

The engine is dependent upon the engineer for the supply of its fuel, for its repair, and for the removal of its refuse; whereas the body has special organs for the performance of these different functions.

The digestive organs supply the blood with fuel and water; food and drink enter the digestive tract through the mouth, and are so changed during the function called digestion by the juices in the mouth, the stomach and the intestines, as to be fit for the nourishment of all the tissues of the body.

The oxygen is taken from the air which is breathed in and out of the lungs during respiration.

The food, water and oxygen enter the blood as it circulates through the organs of the digestive tract and the lungs, and by the blood is carried to the tissues of the body. The different kinds of tissue have the peculiar property of being able to select from the blood the special nutriment necessary for their structure.

The tissues, by doing their work, are constantly wearing away and casting off waste products; these waste products enter the blood, and are carried by it to the excretory organs—the lungs, the skin, and the kidneys, by whose function of excretion they are cast out of the body.

The work of the body is carried on by the burning of the food by oxygen; the food becomes part of the body, so that it is the body which is burnt and gives off waste products. We can regard the tissues as made up of several little atoms or particles, which become oxidised or changed into waste products, and by this process, heat and force are generated; but the atoms must be re-

newed and the waste products removed. This is effected by the circulation of the blood, which we saw brings to the atoms the nutriment they need, and carries off the waste products.

The heart, by its contractions, sends the blood circulating through the blood vessels to the tissues in all parts of the body. This is called the function of the circulation.

These functions—the digestion, respiration, circulation and excretion—kept working harmoniously together by the nervous system, constitute life.

CHAPTER II.

THE EFFECT OF EXERCISE UPON THE FUNCTIONS OF THE BODY.

In Landois and Stirling's Text-book of Physiology, we read:—"Gymnastic exercise is most important for the proper development of the muscles and motor power, and it ought to be commenced in both sexes at an early age. Systematic muscular activity increases the volume of the muscles, and enables them to do more work. The amount of blood is increased with increase in the muscular development, while, at the same time, the bones and ligaments become more resistant. As the circulation is more lively in an active muscle, gymnastics favour the circulation, and ought to be practised, especially by persons of sedentary habits, who are apt to suffer from congestion of blood in the abdominal organs. An active muscle also loses more oxygen, and produces more carbonic acid gas, so that respiration is also excited. The total increase of the metabolism (change in the tissues) gives rise to the feeling of well-being and vigour, diminishes abnormal irritability, and dispels the tendency to fatigue. The whole body becomes firmer and specifically lighter (Jager)."

Muscular exercise stimulates the heart, and so the circulation; the heart beat is

strengthened and quickened, and the blood circulates more freely. It is thrust through the arteries by the force of the contraction of the heart muscle; but when it reaches the veins, the force has expended itself, and the circulation now depends upon the contraction of the muscles of the body. Veins are composed of thin walls, and inside them are placed valves, which will only allow the blood to course towards the heart; when a muscle contracts, it presses upon the veins, squeezes the blood out of them, and so forces it onwards to the heart, the valves preventing it from going in the opposite direction.

The lungs are stimulated; more oxygen thus enters the blood, and more carbonic acid gas is given off, the expansion of the chest is increased, and the air passes into the most remote air cells. The digestive organs are stimulated; the powerful muscles of the abdomen, by their contraction, press upon the contents of the abdominal cavity, and by kneading them increase what is called the peristaltic action of the muscles of the stomach and intestines, and thus the food is hastened along the digestive tract, and the daily evacuation of the bowels, so necessary to health, is brought about without the use of the harmful drugs that the public are so fond of taking, relying, as they do, so implicitly upon the genuineness of the bold advertisements of the enterprising quack.

Although the good that follows this natural stimulation of the heart, lungs and digestive

organs is enormous, yet it is to the function of the excretory organs that we specially wish to draw your attention, for this function of purifying the blood depends to a very great extent upon muscular exercise. The blood thus purified nourishes properly all the tissues of the body, and perfect health is the result. Test this statement by trying the following experiment, which we will call the brain test.

Give a man a certain amount of brain work to do in a crowded city office, where the ventilation is inadequate to supply the requisite amount of fresh air, and we will suppose that the man's only daily exercise is the walk to and from a station on the underground railway. Soon he will on returning to his home complain of headache and a feeling of goneness; he will be irritable and cross with his home circle, and, after a hearty evening meal, will feel drowsy and drop off to sleep. Each day his work will become more irksome, and his irritability worse. Give the same man the same amount of work to do in a country office, well ventilated, and let him spend the time that he would take in getting to his London office by train in healthy exercise. His work will be easy and a pleasure to him; his headache will cease; he will not be irritable or drowsy, for the cause of these unpleasant symptoms is due to the impurity of the blood that supplies the brain with nutriment. The city office is stuffy—that is, the air in it contains many impurities, of which carbonic acid gas is the chief; the blood, instead of being

charged with a good supply of oxygen and relieved of its carbonic acid gas, is sent back to the tissues from the lungs laden with carbonic acid gas, and with less oxygen than is necessary for their nourishment. It is here again surfeited with carbonic acid gas, one of the chief waste products of the tissues; and as the day proceeds, the impurities accumulate more and more in the blood; the man goes home worn out with his work, raves at his household, is despondent about his business affairs, and after a time becomes hypochondriacal, and so a burden to all his companions; his system by this time has become impregnated with his waste products, and all kinds of nervous disorders, called by many different names, are the heritage of the sedentary man. Disorders which could have been so easily warded off by daily cleansing his internal economy, and ridding it of the waste products that have accumulated there, by using a suitable form of muscular exercise, either in the open air or in a well ventilated room.

The ordinary individual pays great attention to the supply of the fuel, otherwise he suffers pain from hunger, but he pays little heed to the necessity of a good expansion of his lungs for the supply of a sufficiency of oxygen, and still less attention to the getting rid of his waste products by exercise. People leading a sedentary, inactive life allow impurities to accumulate in their systems, and lay the seeds of such painful diseases as gout and

rheumatism. All their vital organs become weakened by the conversion of their well-nourished tissue into tissue which is improperly nourished and of very feeble resistance; that is, they become flabby, because of the supply to them of impure blood. It is not at all uncommon to find the heart encased in a thick layer of fat, or even its walls containing much fat, instead of being made up entirely of healthy, active, muscular fibre; a fatty heart is the most dangerous form of heart disease. Fat is deposited in the system when the different functions of the body have not been properly regulated; the weakening of the tissues makes them very susceptible to any form of illness, and those who mean to keep themselves in a good state of health must devote a certain portion of their time to systematic exercise, so as to rid themselves of the impurities that create such sad havoc if left in the body.

Many different systems have been from time to time advocated for the reduction of fat by diet and drugs. Dr. Whitla, in his Dictionary of Treatment, has written an able article upon obesity. He says: "As a rule, it may be said that the treatment of obesity by the administration of drugs should be left out of the question; if used at all, they must play a very subordinate part." He then strongly condemns the use of large quantities of vinegar. "Exercise is a powerful factor in the prevention of obesity. No system of treatment will be complete which does not

recognise it as an important element." In contrasting the different systems of dietary, Professor Wood's figures are of much service.

Average food of a	Albuminous Materials.	Fat.	Starchy Hydro-Carbons.
Healthy Man. ..	30 drachms.	25 drachms	92 drachms.
Banting's Dietary..	43 ,,	2 ,,	5¼ ,,
Ebstein's Dietary ..	25½ ,,	21¼ ,,	11¾ ,,
Oertel's Dietary ..	45 ,,	9 ,,	25 ,,

Oertel relies chiefly upon the abstraction of water from the body by reducing its supply, and increasing its excretion by inducing sweating by exercise. Schweninger insists upon all the fluid permitted being taken two hours after meals. German Sée insists upon copious imbibition of water, but no alcohol. Weir Mitchell relies upon a diet of skimmed milk and absolute rest in bed, with massage, and later on exercise. The Salisbury method consists of a diet of beef steaks and hot water. Schroth advocates the "Dry-cure," in which no fluid is allowed.

Dr. Yeo's method (in our opinion the best) may be given in his own words:— "The two principal objects of all these methods are, first to make the corpulent person consume the excess of fat deposited in his body by restricting the food supply or augmenting its combustion by increased physical exercise or other means; and, secondly, to establish a dietary which shall prevent its re-accumulation. None of the methods described are appropriate to the treatment of all cases of obesity indiscri-

minately, while any one of them may prove successful in suitable instances. In conclusion, the following is the method which we recommend to be generally adopted :— A very careful examination should be made of each case, in order to ascertain the presence or absence of any organic disease, especially of any cardiac degeneration ; and if we are satisfied that the obesity is not secondary to any other morbid state, or associated with any general degeneration of organs, we may proceed with confidence to prescribe an appropriate régime. The albuminates, in the form of animal food, should be strictly limited. Farinacious and all starchy foods should be reduced to a minimum. Sugar should be entirely prohibited. A moderate amount of fats should be allowed. Only a small quantity of fluid should be permitted, but enough should be allowed to aid in the solution and digestion of food. Hot water or warm aromatic beverages may be taken freely between meals, or at the end of the digestive process, especially in gouty cases, on account of their eliminative action. No beer, porter, or sweet wines of any kind are to be taken, and no spirits, except in very small quantities. It should be generally recognised that the use of alcohol is one of the most common provocatives of obesity. A little hock, still Moselle, or light claret, with some alkaline table water, is all that should be allowed. The beneficial effect of such a diet will be aided by *abundant exercise*, and by

the free use of saline purgatives; so that we may ensure a complete daily unloading of the intestinal canal. Of animal foods, all kinds of lean meat may be taken: poultry, game, fish (eels, salmon, mackerel, are best avoided), eggs. Meat should not be taken more than once a day, and not more than 6 ozs. of cooked meat at a time. Two lightly-boiled or poached eggs may be taken at one or other meal, or a little grilled fish. Bread should be toasted in thin slices, and completely—not browned on the surface merely. Hard captain's biscuits may also be taken. Soups should be avoided, except a few tablespoons of clear soup. Milk should be avoided, unless skimmed, and taken as the chief article of diet. All milk and farinaceous puddings and pastry of all kinds are forbidden. Fresh vegetables and fruits are forbidden. It is important to bear in mind that the actual quantity of food permitted must have a due relation to the physical development of the individual, and that what would be adequate in one case might be altogether inadequate in the case of another person of larger physique."

Inasmuch as fat is very often deposited in the tissues from insufficient muscular exercise, we cannot help thinking that, where it is possible, it is far better and more natural to use carefully devised exercises, instead of relying upon drugs or a strict dietary, which we fear in too many cases only increase the weakness of the tissues, which are too weak

already. Common sense seems to say remove the cause, a safe cure will be the result, and the individual will be strengthened instead of weakened ; and our experience has taught us that the practice coincides with the theory, for in the treatment of obesity by active movements, the fat disappears, and the patient's health and strength become greatly improved.

It seems such a curious fact that a nation who makes such an enormous point of the importance of the cultivation of the mind by education should, at the same time, apparently wilfully neglect the cultivation of the body, knowing that the two must necessarily go hand in hand. If the brain is developed in a neglected body, disease in some form or other will, sooner or later, inevitably appear ; but if physical health culture is conducted alongside the brain culture, then the best results will be obtained, not only by the body, but also by the brain.

The future generations, too, have to be considered. What kind of offspring, think you, are likely to be begotten by parents who are unhealthy and flabby, from insufficient bodily exercise ? Moral defects and crime are as often due to physical shortcomings as to a perversion of the mind.

CHAPTER III.

THE CHOICE OF THE PARTICULAR FORM OF EXERCISE.

Having discovered, from a hygienic point of view, the absolute necessity of exercise, we must now enquire carefully into the different forms of exercise which are most commonly taken. There are undoubtedly many forms of healthy exercise which have, however, many drawbacks attached to them ; take walking for instance, perhaps the most common, and certainly a very useful and healthy form of exercise, if conducted on scientific lines. A man, if he would enjoy good health, should walk at least eight miles every day, at the pace of four miles an hour ; his step should be springy and full of life, he should swing along, not slouch, with head erect, chest out, abdomen in and shoulders squared; many, however, from inattention to their gait, suffer from deformities, such as drooping or round shoulders, and a contracted chest, and very few can afford to allow themselves two hours a day for exercise, or would be willing to face inclement weather, if necessary ; others are so fearfully crippled by wearing fashionable boots, that walking for any distance is quite out of the question.

If only suburban people, who have to go to the city every day, could realise how their

health would improve if they saved a penny each way on their 'bus or train fare, there would be an appreciable fall in the price of the shares of the different companies.

The great value of walking exercise is manifested by the fact that it is always used by men in training for any kind of contest.

Many, especially the younger men, rely upon sports and games for their exercise ; cycling, rowing, cricket, football, riding, lawn tennis, golf, swimming, etc. They are all good up to a certain point, but do not afford exercise for all the muscles of the body ; they all require time and money, and may lead to trouble, inasmuch as by the overwork of some muscles, and the underwork of others, slight deformities, such as contracted chests, the drooping of one or both shoulders, may be engendered. The necessity of companions makes it almost impossible to get regular daily exercise from games, except for the favoured few, and the weak are often left out in the cold, because they do not possess the requisite amount of stamina. Another danger which threatens to completely undo all the good otherwise obtained, is that of over-exertion, this especially applies to cycling, rowing, and athletics. Ours is a plucky nation, and we like to vie with one another in friendly contests, and endure much suffering in the form of fatigue therefrom ; the strain upon the heart and the other vital organs is enormous, and racing men whose one ambition in youth is to break a certain

record, do so, but often have to suffer from the ill-effects of it in later years.

Dr. James Cantlie, in an article entitled "The Effect of Exercise upon Health," gives the following list of dangers that attend over-exertion in any form of exercise :—

1. Gradual falling off in tone and vigour.
2. Rupture of a muscle.
3. Rupture of a blood vessel in the lung, brain, or eye.
4. Dilatation of a cavity or cavities of the heart.
5. The giving way of a diseased valve in the heart.
6. Catching cold from exposure, and so lung trouble.
7. A host of abdominal and cardiac troubles.

Dr. Dukes says: "Excess of exercise wears out and stunts ; exercise in proper measure produces health and strength."

Dr. Creighton Brown, that "Athletes, as a rule, are stupid and dull, because excessive exercise starves the brain."

Dr. Herschell, in writing on cycling: "The rider must carefully avoid the temptation of rushing the last few yards in climbing a hill. More weak hearts are permanently damaged by this than most people imagine. You are climbing a hill, you are near the summit, a few more strokes are all that are required to enable you to surmount it. But these last few strokes are harder work than any which have preceded them ; your heart's action is

already most probably accelerated, and the extra strain thrown on the overtaxed organ frequently produces serious injury."

Do not think for one moment that we in any way wish to disparage the value of healthy recreation; we ourselves in the past have taken part in many contests, and are proud of the prizes which remind us of the events, and still take the keenest interest in the national sports and pastimes. As soon as the Englishman's love for sport disappears, then good-bye to England's greatness. We thoroughly appreciate all the good effects; but, as this is a scientific treatise, are compelled to point out the attendant dangers, dangers which a scientific knowledge of the art of training would do much to counteract. Even with a full knowledge of these dangers, we have always encouraged, in every way, all forms of healthy out-door amusements, because the drawbacks both from a healthy and moral point of view are so small, compared with those attendant upon inactive indoor entertainments. The greater the pride a young man takes in his muscular development, the less likely is he to fall a prey to the manifold temptations that everywhere beset him in this go-a-head age.

Our ambition is to do the greatest amount of good to our fellow-creatures; or, in other words, to put them into a position for acquiring the most valuable gift to man—perfect health. We should, therefore, like to dwell for a few moments upon the subject of training.

CHAPTER IV.

THE ART OF TRAINING.

Upon the subject of training authorities differ to an alarming extent, and each has a following which swears by him, and will as excitedly argue about the details as do enthusiastic politicians at election time. As in so many other cases, from a lack of knowledge of the scientific part of the subject, men have gone out of their way to make simple matters complicated, we shall merely put forward the main principles that must underlie every good system, and leave others to fight out the unimportant matters for themselves; straining at the gnat will do no harm, so long as the camel is not swallowed.

Regularity and moderation is the keynote of success in training; this applies to eating, drinking, exercise, and rest. Prince Ranjitsinhji, in his book on cricket, says that temperance in food and drink, and regular sleep and exercise, is the golden rule in training.

We regard the ordinary public school-boy (who is, of course, debarred from using the tuck shop) as being in a good state of training; he has a varied but plain and sufficient diet, he has his meals at regular and good intervals, he goes to bed and gets up early, and at the same time each day. The

regular daily exercise should be taken at the same hour each day, if possible, and should be moderate; far better results will be obtained by just working up to the point of fatigue than by daily trying the power too much.

All the organs of the body need attention; do not neglect one in your endeavour to get another into a state of perfection; all work harmoniously together and depend for their well-being on one another. Of what profit is it if you strain your heart in your attempt to get a long wind?

The exercise of the muscles, that you think are the only ones needful for your particular form of sport, will end in far less satisfactory results than the development of all the muscles of the body; it will, at least, prevent the tendency to any athletic deformity.

An erroneous physiological view was formerly held that each time a muscle contracted, a destruction of its substance took place, which corresponded to the amount of work done, and that this was manifested by an increased excretion of nitrogenous waste (urea); this waste was supposed to be made good by the consumption of large quantities of nitrogenous food (meat). Hence the old notion, which luckily is fast dying out, that the greater amount of steak consumed, the greater the strength obtained. The more a man eats beyond the amount necessary to nourish the tissues, the weaker he becomes; because, by over-eating, an extra amount of

work is thrown upon the digestive and excretory organs, and the amount of energy necessary to get rid of the superabundance is energy wasted, and must be deducted from the strength that would otherwise be obtained.

It has been proved that there is little, if any, extra nitrogenous waste; in fact, nothing more than the ordinary wear and tear of the muscular tissues, during active muscular exertion; but there is a great increase of non-nitrogenous waste (carbonic acid gas and water), and this waste must of course be made good by eating non-nitrogenous food—vegetables, bread, etc.

Nitrogenous food is chiefly used in the building of the tissues, and it is the non-nitrogenous food that is of the force-generating quality.

We learn from this that in training it is just as necessary to eat vegetables, bread, and such like non-nitrogenous or force-producing foods, to supply the non-nitrogenous waste produced by the work of the muscles, as it is to eat meat and its allied nitrogenous or tissue-forming foods, to renew the nitrogenous waste from the ordinary wear and tear of the muscular tissues. Both kinds of foods are requisite, which proves that the school-boy's ordinary mixed diet is correct.

The well-trained man is the man whose whole body is healthy, with all its organs in the very pink of perfection, and in harmonious working, the one with the other. We daily

see instances of people condemned to invalidism, simply from want of muscular exercise, and are quite familiar with the other side of the picture, dilatation and consequent weakening of the heart and of the air cells from over-exertion.

Occasional over-exertion may not be permanently harmful, because of Nature's recuperative power; but persistent abuse will certainly gradually ruin this power, and bad results will follow, which may be latent for a time, but must, sooner or later, become manifest.

The maximum of recuperative power is present only in the perfectly healthy man, and this power must be carefully attended to whenever we exercise ourselves; under-activity or over-activity lessens, while the happy mean increases recuperative power, and so health and strength, which must be the aim of good training.

The maximum cannot be attained in a single training; it is the outcome of steady perseverance for years. A young man makes up his mind to be proficient in some form of athletics; let him at once go into rational training and keep in training, and his powers of endurance will increase with each contest; unless, of course, he is foolish enough to attempt feats beyond his strength. It takes quite three years to acquire a perfect muscular development, and until this is done, a man cannot be at his best; he must devote twenty minutes each day to his general muscles, in

addition to the time that the special exercise of his sport demands. Sudden changes in the mode of living are very detrimental to perfect health, and yet this is the system of training in vogue at the present day. The man enters for a certain contest, and for a few weeks goes into strict training; he rapidly loses weight, looks pale and thin, feels uncomfortable, and is very susceptible to cold and other ailments. After the contest he goes out of training, and rapidly loses his condition; this is far removed from what Nature desires. She insists upon regularity and moderation, and, in return, generously showers upon her followers the valuable rewards of health and strength. An athlete should always be in good condition (not in the hyper-sensitive state that most trainers think necessary), and then, before a contest, all he needs is a final polish. To prove the correctness of our theory by practice, we would ask how many of our champion athletes live through a healthy old age; our weight-lifters generally die before they reach the age of forty, when they should be at their prime. To what does our champion cricketer, Dr. Grace, now in his fiftiéth year, and still capable of holding his own against the world, attribute his success? To a rational system of continued training, both summer and winter, and to his dogged perseverance in overcoming the difficulties associated with cricket. In his book on cricket, W. G. Grace writes: "We have always been a temperate family—another point to be considered is

constant exercise of some kind throughout the year—I find a day's shooting or fishing, or a run with the harriers or beagles, of great use during the winter months, and I take care to have plenty of walking. In the months of February and March I begin to prepare for the season, increasing my amount of exercise, and, by the beginning of May, I feel fit enough to face the cricketing season."

CHAPTER V.

THE RELATIVE VALUE OF THE DIFFERENT KINDS OF FOODS.

It is a common custom to reckon the amount of nourishment, by the amount of meat eaten; meat should only form a limited portion of our diet. Just as there is intemperance in drinking, so there is intemperance in eating, which is just as wrong, and as surely brings its own punishment—namely, loss of health.

A combination of food-stuffs is necessary to ensure a healthy digestion. We need a combination of the tissue-foods, the stronger and the weaker fuel-foods, and water and salines. The tissue-foods (meat, etc.) have also been named nitrogenous and albuminous substances. The stronger fuel-foods (amyloids and fats), hydro-carbons; the weaker fuel-foods (starch, sugar, etc.), carbo-hydrates.

It has been proved by experiments that an averaged-sized man, doing an average day's work, requires about $4\frac{1}{2}$ oz. of tissue-food, 3 oz. of strong fuel-food, 14 oz. of weaker fuel-food, 1 oz. of salines, and from $3\frac{1}{2}$ to $4\frac{1}{2}$ pints of fluid per day.

Working upon these calculations, we can readily ascertain the amount of the different kinds of food that is really necessary to keep

us in health. In milk we have all these food-stuffs, but they do not all exist in other foods. Butchers' meat contains tissue-food and strong fuel-food, but little weaker fuel-food; so that while half a pound of meat will supply us with the 4½ oz. of tissue-food, and the 3 oz. of strong fuel-food, it will not supply the 14 oz. of weak fuel-food, so that we cannot satisfactorily live entirely on meat; in fact, we require twice as much of the weaker fuel-foods as we do of the tissue-foods and the stronger fuel-foods put together. We want some other kind of food to supply the 14 oz. of the weaker fuel-food.

Vegetable food contains all four food principles, and therefore people are able to live on vegetables alone; many do so, and call themselves vegetarians; but since vegetables contain a very large amount of weaker fuel-food, and very small amounts of the tissue-food and the stronger fuel-foods, a vegetarian would have to eat a very large quantity of vegetables in order to get his 4½ oz. of tissue-food and his 3 oz. of strong fuel-food, and would thus eat too much of the weaker fuel-foods. But suppose, now, the diet consists of meat and vegetables, it is an easy matter to regulate the amounts of each in order to meet the calculations mentioned above. We shall require rather less than ½ lb. of meat, and rather more than 14 oz. of vegetables; shall we say then that our daily diet should consist of about ½ lb. of meat and about 1 lb. of vegetables.

But although the mixture would theoretically be sufficient to support life, practically we should find that the stomach would rebel against such a sameness of food, and we find that a change of diet is necessary.

Bread contains a food-principle very similar in property to the tissue-food contained in meat; and, as in the case of vegetables, we can find in bread all the food-stuffs, but there is a superabundance of the weaker fuel-foods, and very little of the other two. A combination of bread and meat will make up our dietary. Brown bread is far more nutritious than white bread, for the coats (or bran) of the grain contain a greater quantity of tissue-food, fat, and salines, than does the white central starchy portion of the corn; so substitute brown for white bread, and you will require less meat.

But we cannot live upon meat and bread alone, because there is present in fresh green vegetables and fruits certain food principles that are very necessary for our diet.

The three great classes of foods which we require for our daily diet are meat, vegetables, and bread, and we have found that a combination of these three foods will supply us with the necessary amount of food principles, since they contain the tissue-foods—the stronger and weaker fuel-foods—salines and water; there is not, however, sufficient salines and water to supply the 1 oz. of salines and the 4 pints of water, so we must take some salt and some water with our

meals, either pure or flavoured with beverages such as alcohol, tea, coffee, &c.

A change of diet is necessary, so let us examine further into these different classes of food-stuffs.

Our class meats must include butcher's meat, game, poultry, and fish. Vegetables—All kinds of garden produce, including fruits. Bread—Articles of diet such as oatmeal, rice, sago, tapioca, &c.

As to butcher's meat. Mutton is more digestible than beef, but rather less nourishing. Pork is both less digestible and less nourishing than either; this includes sausages, though it is said that it is impossible to say of what sausages consist. Then the meat of old and young cattle is not so easily digested—lamb and veal, though nourishing, are trying to a weak stomach. Meat, by being cured, is rendered more indigestible, except bacon, which is a very valuable food; fat bacon especially is most useful in cold weather, particularly for those who have lost flesh, as consumptives, etc.

Game and poultry, except geese and ducks, and perhaps hares and rabbits, are easily digested, and suitable for delicate people.

Fish, though not so nutritious, is more easily digested than meat, and some kinds, such as whiting, sole, flounders, plaice and dabs, are particularly well-suited for those recovering from an illness. Oysters, too, eaten raw, are suitable for invalids; cooking renders them rather hard. Shellfish can only

be eaten by some people; others are entirely upset. Sickness and nettlerash are frequently caused by eating them.

Eggs lightly boiled, poached, or raw, are very nutritious and easily digested. So are tripe and sweetbread.

We said just now that fresh vegetables contained some kind of mineral matter which is absolutely essential for health, and it is a well-known fact that unless the crew of ships are supplied with fresh vegetables, or with fruit, such as oranges, lemons, limes, etc., scurvy will break out amongst them.

Potatoes, properly cooked, asparagus, lettuce, seakale, vegetable marrow, broccoli, cauliflower, and cooked celery are easily digested, and are most necessary articles of diet. Cabbage is not quite so digestible; neither is spinach. Peas and beans contain much more tissue-food than other vegetables; they are, therefore, very nutritious, and form, perhaps, the chief item in the diet of vegetarians; yet, they are somewhat inclined to cause flatulency, and hence are not very digestible. They should be eaten only when they are young and fresh.

Bread, often called the staff of life, made by baking wheaten flour, if well made and baked, is easily digested. Brown bread, although more nutritious, is not so easily digested.

Oatmeal is very nutritious, containing as it does much tissue-food, and cannot be too highly recommended as a breakfast dish. It should be well cooked.

Rice, sago, tapioca, arrowroot, require to be well cooked, and then are easily digestible, and are much used for making the milk puddings so often ordered for the sick.

Cooked Food.

Nearly all the food that we have mentioned is cooked, and so rendered more digestible, more appetising, and more refreshing and invigorating to a body worn out by hard work and fatigue, especially in cold weather.

It renders the fibres of meat more brittle and loose, so that they are more easily broken down by the teeth in eating, and the juices of the digestive tract can penetrate them more easily. It breaks up the cells containing the starch in vegetables, and so makes them more digestible. The various means used for cooking the articles of food give us a greater variety in diet.

Boiling makes meat more digestible than does roasting, grilling, or broiling. Baking and frying are not good for the digestion of the weak.

In order to make the meat most nourishing, you should, if you boil it, immerse it at once into boiling water for five minutes, or if you roast it, you should expose it to an intense heat for five minutes, because you will then, by hardening the outside of the meat, prevent the juices from escaping. Afterwards proceed with your cooking at a moderate heat, so that the flesh does not shrink too much or become too hard. Meat loses about

a quarter of its weight in cooking. If meat is stewed properly at a low heat, it is made very digestible. Dr. Pavy advises the following plan :—Place a chop or other small piece of meat in a jar, tie something over the top of the jar so as to keep the vapour in, place this in a saucepan, in which the water is allowed to simmer until the chop is properly cooked ; this you will find surrounded by its own juices, but serve it up as it is, without sauces, and you will find that it can be readily digested by the invalid.

Potatoes are best steamed or cooked in their skins. Rice, sago, tapioca, &c., should be well cooked.

Having hurriedly considered the various articles of diet, doubtless you expect us to advise as to your daily dietary.

First of all, then, do not eat too much meat, as the extra amount beyond what is necessary gives the excretory organs a large amount of extra work, and after a time you may be sure that you will suffer from indigestion, and probably gout, for gout is more frequently caused by over-eating than by over-drinking. Those engaged in laborious and outdoor work require and can eat with impunity more meat than those engaged in sedentary employment indoors.

Remember that there are many articles of diet which contain nearly as much tissue-food as meat, and are cheaper, and those of you who cannot afford much meat should eat more oatmeal and cheese, and such vegetables as

peas and beans. Cheese is a most valuable and cheap article of diet, and contains much more tissue-food and fat than does meat. Skimmed milk and butter-milk again are very nutritious and cheap.

Three meals a day are quite sufficient for the hale and hearty, and by this arrangement the organs of digestion will be given plenty of time to perform their work. Meat should not be introduced more than twice a day, and it is utterly wrong to eat between meals.

Let your meals be regular and take plenty of time over them; eat slowly and well masticate the food; and do not let your business call you away in the middle of your meals. Let your principal meal be in the middle of the day, and above all things do not make a heavy supper, and let there be an interval between your supper, if even a light one, and bed time.

If you do lose a little money by not attending to your business while you should be attending to your meals, it is money well lost, for if you lose your health, you will become unfitted to gain your money during business hours.

Your diet should be varied, for the stomach will not bear a sameness of diet.

It should be mixed, consisting of food whose principal ingredient is the tissue-food, and other foods containing the fuel-foods and salines.

If you attend to these points, indigestion will never trouble you, for in 99 out of every

100 cases of dyspeptics, we can put our finger down upon one of the above rules and say that it has been broken. The digestive organs become gradually impaired by being improperly treated, and for a time it appears that no evil results follow the bad practices, but at last the well-known symptoms of indigestion begin to appear and gradually get worse; you consult your medical man and are surprised that he is unable to cure in a few days the damage that you have been slowly inflicting upon your organs for perhaps years.

CHAPTER VI.

THE IDEAL FORM OF DAILY EXERCISE.

We ought now to be in a sound position to come to a correct conclusion upon the ideal form of daily exercise; there are so many important conditions to be fulfilled, that our choice has been already much curtailed. We will classify these conditions as follows: It must be:—

(*a*) Easy of access.
(*b*) Inexpensive.
(*c*) Suitable for old and young, and for both sexes.
(*d*) A system that does not take up too much time.
(*e*) Efficient—that is, must include suitable exercise for all the muscles.
(*f*) Easy to learn, and simple in construction.

There is only one system that quite fulfils all these conditions, and that is a complete system of exercises arranged by Mr. Luis J. Phelan for the Whitely Health Exerciser, which consists of a rubber cable passing over pulleys; to each end of the cord, handles are attached, and by reversing the pulleys, either an upward or downward stroke can be made. It takes up very little room, and is an ornament; it can be easily fixed by means of two small screw-hooks—one placed about

seven feet from the floor in the wood work of the door frame, and the other into the floor itself; it is often moved from one room to another; some people use it at one part of the day in their bedroom and at another in their sitting room, and travellers carry it about with them and fix it in their bedroom at the different hotels. It can even be fixed to a bedstead and used by a person lying in bed.

The price is within the reach of all, rich and poor alike, and machines are made of different strengths to suit children and ladies, men, and athletes.

By spending 15 minutes daily—say 5 minutes in the morning and 10 minutes at night—all the muscles in the body can be sufficiently exercised if the instructions on the chart are carefully followed.

Good results can doubtless be obtained by a daily attendance at a well-equipped gymnasium, under a competent instructor, or by the proper use of light dumb-bells or the pulley-weight apparatus, but not one of these will quite fulfil all the necessary conditions. Every movement that can be done at a gymnasium by dumb-bells or the pulley-weight apparatus can be done by the Exerciser, which is a complete gymnasium in itself, embracing all the exercises that can be done by any other more complicated and expensive apparatus.

CHAPTER VII.

THE DIFFERENT TYPES OF MUSCULAR DEVELOPMENT.

The different kinds of muscular development differ very much both in point of strength and utility. We recognise three distinct types, the hide-bound or hypertrophied, the bunchy and the ideal.

The hide-bound muscle, at once detected by its hardness, even when in a state of relaxation, is developed by overwork; although it may be of service in slow, heavy work, it is quite useless for quick, active movements; at any time it is liable to atrophy, or waste away, and has very little recuperative power.

The bunchy muscle is only partially developed; the part that, when contracted, stands out prominently and forms the bunch, is developed, and looks enormous, because the rest of the muscle is undeveloped; it may be either hypertrophied or pure, according to the method used in its development.

The ideal muscle is the muscle that contains the largest and greatest number of pure muscular fibres, and is perfectly developed throughout the whole length of its body; it is long, thick, and broad when contracted, and is quite soft when relaxed. It is a far more valuable test of the general utility of a muscle to examine it when in a state of relaxation;

for if it is quite soft, like so much fat, it must be free from an excess of fibrous tissue which gives the hardness to the relaxed hide-bound muscle.

The ideal muscular development to the untutored eye may not appear to be so powerful as the hide-bound or the bunchy, because it is pure, and so conforms to the natural curves so well known to artists, and its size is lost in its beautiful conformity; but it will at once show its superiority when tested as to its strength and utility.

For the acquisition of the ideal development, every care must be taken that the muscles are placed under the most favourable conditions during exercise, a free supply of blood to the active muscle must be encouraged; otherwise, instead of the development of the highly nourished muscular tissue, fibrous tissue will appear, and the result will be an ugly, unhealthy hide-bound, in the place of a graceful, ideal, healthy muscle.

The amount of the weight and resistance imposed upon the working muscle is of the utmost importance. We find the following statement in Kirke's Text-book of Physiology:

"It has been found that in order to obtain the maximum of work, a muscle must be moderately loaded; if the weight be increased beyond a certain point, the muscle becomes strained, and less work is accomplished."

From this we learn that the best results are obtained from the use of a moderate resistance, although some people believe in

exercises performed without any apparatus, and others advise the use of heavy weights; but as is so often the case when there are two extremes advocated, the mean or middle course is the right one, and we find that the ideal muscular development is rapidly effected by the quick movements of a moderate resistance.

There is still another very important point that has to be considered, and that is the part of the contraction upon which the greatest resistance ought to be brought to bear. This must be at the end of the contraction, when all the fibres of the muscle are at work, for the fibres of a muscle contract in a wave-like order, beginning nearest the point of stimulation, and spreading gradually until all the fibres become engaged.

Dr. George Herschell, in the *Lancet*, writes: "To produce a mechanical resistance, we may make use of either a pulley-weight apparatus, or one in which the effect is produced by tension of rubber cords. As a result of my experiments, I have decided that the rubber cord presents many advantages. My reasons are mainly the following: 1. In a machine, in which the resistance is produced by a weight, the force to be exerted by the operator is the same at all points in the range of movement. Moreover, it is actually necessary to exert the most power at the commencement of any given stroke or movement, in order to overcome the inertia of the machine, and start the weight from its point

of rest. Now, this is just what we do not want. I am informed by professional gymnasts that it is a fact, well recognised by them, that a muscle is not able, without strain, to exert its full force until it has got well under weigh —so to speak—and for this reason they prefer apparatus worked by an india-rubber cord in which the power exerted by the machine slightly increases continually up to the end of the movement. 2. A pulley-weight apparatus is more difficult to apply to patients in the recumbent position. On the other hand, a machine consisting of a rubber cord, passing round pulleys, can be attached in many different ways to the bed or the adjacent wall. 3. The difference in price. A pulley-weight apparatus costs several pounds, the alternative machine a few shillings. Personally, I use an exercising machine which is on the market, and is of American manufacture (The Whitely Exerciser). It is very perfectly constructed, and answers my purpose admirably. It consists of a long rubber cord, terminating at each extremity in handles. This cord passes round three pulleys, which can be variously grouped and attached by hooks to the wall or the rails of the bed. We can then, by a proper arrangement of this apparatus, oppose resistance to almost any movement of the patient, either lying, or standing, or sitting."

The gradually increasing resistance of a long elastic cable playing over pulleys affords the muscles every chance of becoming developed under the most advantageous

conditions; the slight resistance at the beginning of the contraction is sufficient to draw the blood to the muscles engaged in the movement, and the evenly increasing tension right up to the maximum contraction, promotes a development of fibres throughout the whole body of the muscles while they are well supplied with blood. The pull should always be made smoothly, without any shock or jerk at either end, otherwise this valuable principle of the machine is lost; and if our readers follow out the instructions laid down in this book for the localisation of muscular movements, and are content to perseveringly use a machine that is not too strong for them, we can safely guarantee them an ideal development of their muscular systems.

CHAPTER VIII.

THE NEED OF EXERCISE FOR WOMEN AND CHILDREN.

MANY arguments have been brought forward condemning muscular exercise for women, owing to their possession of a special set of organs connected with child-birth; but our experience from general practice in the country is that the better developed the muscular system, the healthier and stronger the organs, and the more capable of doing their work when called upon during labour, which, by the way, is a good name—it is labour, indeed, and needs a good muscular development.

Many women altogether lose their figure after having a large family; there is no reason at all why this should happen if the relaxed abdominal muscles are made to regain their normal condition by proper movements, as laid down in a scientific system of exercises. Then, again, how many suffer from misplacements, owing to loss of power of the supporting muscles and ligaments.

Dr. Galabin, in dealing with the hygiene of pregnancy, writes: "It is of great importance to keep up a reasonable amount of exercise to preserve the muscular system in good tone. Women of the labouring class, who work in the open air during pregnancy, pass through their confinements with much greater ease

than those who lead sedentary lives. It is reasonable to expect that women who spend a great part of the day in bed, or on the sofa, will be ill-prepared for the severe muscular effort required in labour. On the other hand, excessive fatigue, strains, and the lifting or carrying heavy weights are to be avoided."

Dr. Thorburn, in his practical treatise on the diseases of women, writes: "Proper exercise is just as essential to the preservation of female health as timely rest. Just as the really well-cultured woman frequently excels her male competitors in moral inspiration, so the woman who has had free play for her muscles while a girl, and in young womanhood, and who has not been injured by the unwomanly work of savage or of over-civilised life, excels him, in many ways, in her powers of endurance. Few, if any, men could endure the sustained fatigue daily and hourly undergone by the mother of a family in poor or very moderate circumstances; and as the necessity for this will endure as long as the perpetuation of the race is carried on, on its present lines, it is essential that the muscular system of women should be considered in their hygienic training."

These two quotations from the books of eminent medical men are sufficient to impress upon us the necessity of exercise for women; but inasmuch as they are not so powerful as men, and are not built by nature for the performance of such heavy work, they should always use a very light machine.

It is just as foolish for a woman to attempt such heavy exercise as a man, as it is for a slightly built man to attempt the feats of the more strongly built.

Another objection that has been raised is, that a woman is likely to spoil her figure by exercising her muscles. We have already pointed out that an ideal development improves the artistic curves, and there is no other means of improving the figure than by systematic exercises.

What is more unsightly than the thin, scraggy arms and chest that one so often sees exposed by the low neck dress in the ball room. No woman need any longer be the butt of unkind remarks; she has only to expend a few minutes daily upon the development of the muscles of her neck, shoulders, chest, and arms, and she will soon cease to appear as a skeleton in evening dress. Not only will the figure improve, but also the complexion, for, owing to the increased circulation of a purer blood, and to the free action of the sweat glands (of which there are more than two million in the skin), the texture of the skin becomes soft and silk-like, and its colour youth-like and beautiful.

Dr. Angel Money, in his book on Diseases of Children, strongly advocates the use of suitable exercise. "As a principle of general application, it may be stated that no agency capable of acting on the bodily functions is an unmixed good or evil. Great is the good gymnastics may effect in many diseases;

second only to exercise in the open air, it ranks high as a therapeutic agency. A little physiology puts it on a proper basis; but in practice system is everything. 'Try gymnastics' is very good advice, but the thing is how, when, where? The exercises must be adapted to each individual case. Every carefully and neatly performed muscular act is a gymnastic exercise; muscle is not alone acting; nerve centres and paths come in for the training; blood and blood vessel enter into the education. Every action involves some neuro-muscular apparatus, is attended by physiological nerve and muscle hyperæmia, physiological nerve discharge and muscular contraction.

"Each careful and neatly performed contraction means a definite co-ordinated nerve discharge; this is accompanied by an equally harmonious chemico-physical change in nerve and muscle. So the whole body benefits, for nerve, muscle, and circulation are actually, and excretion with assimilation indirectly, involved. The influence of habit is of immense importance, and applies everywhere in physiology and patholgy. One disorderly movement is as bad as one orderly movement is good; a neat and harmoniously performed mental or muscular act is a power for good; and conversely, clumsiness perpetuates itself.

"The increased respiration and circulation, and any mental inspiration that attend muscular movements are of therapeutic benefit. But here I would deal only with the

great good the nerve centres and muscles gain by harmonious, perfectly co-ordinated muscular acts. This perfect performance must never be done to the point of prostration or fatigue. Palpitation, as a rule, interdicts gymnastics. Muscle and nerve may atrophy from excessive employment. Prostration or fatigue also act adversely on nearly all other corporeal processes.

"In nervous debility. — Feeble-minded, backward, choreic, and neurotic children have their brains, cords, nerves, and muscles improved by instruction in calisthenics or gymnastics.

"This gain is chiefly the result of the direct or special action of the exercises. To effect this, the training, the neatness and perfection of the co-ordinate movements is most wanted.

"In general debility.—Scrofulous, anæmic, feeble-bodied children reap benefit chiefly by the indirect or general action of gymnastics, by the increased circulation, respiration, excretion, and secretion caused by the muscular movements. Under these circumstances co-ordinate movement, training, is of less value than the mere action or motion.

"Methods.—Professors of calisthenics justly and properly exist. Deportment in standing, walking, and performing movements with ease and grace is an art. Nature is not always graceful, harmonious, and artistic. The exercises must be taken as school lessons are, or should be. Children may be cured of

stammering by being taught how to breathe and how to articulate by a master of elocution. In performances of any kind the aim should be to do them as perfectly as possible. Bending the arm seems a simple act, but it may be performed well or ill.

"The time occupied in these active exercises should be in proportion to the strength of the patient. Ten minutes may be enough. Repetition should be daily, or twice a day, or three times a week, according to circumstances and requirements. The room should not be dusty or ill-ventilated; this is most important in lung affections. Deformities of chest are decidedly cases for calisthenics and special gymnastics. Some of the mechanical appliances at gymnastic institutions may prove valuable. There are a thousand movements to practise, from simple to very complex. Athletic sports are not fit for sickly children; the strain on heart and vessel is too sudden, too great, and too prolonged.

"Flexions and extensions and rotations of joints and trunk should be deliberately performed; indeed, deliberation at the outset of learning is a necessary factor of success. The exercises are arranged to bring any group of muscles and corresponding nerve centres into action. Ordinary drilling is very good for the general effect of gymnastics. When the gymnastics are ordered for cases of palsy, special movements are practised. Attitude requires attention. One group of muscles acts better in one attitude of the

body, another in another. Taking deep breaths, standing at attention, throwing the shoulders back, bending the trunk forwards for the hands to touch the toes, neatly extending the arms from the trunk—are useful movements.

"The mode of execution is important—it should not be too rapid nor too forcible. The movement should be commenced well and quickly, but not abruptly, and finished more gradually. No healthy process—and very few, if any, morbid processes—finishes as suddenly as it may begin. Each movement should be repeated in the same time as the previous one. All these and other points are needed to educate the nervous centres and muscles up to the right standard.

"Counting and singing are excellent means for securing harmonious and regular action. Reading aloud and elocution are valuable training for choreoid individuals, as prophylactic and preventive of relapses. The brain, medulla, nerves, and muscles are thereby trained and better nourished."

CHAPTER IX.

THE USE MADE OF THE WHITELY HEALTH EXERCISER BY THE MEDICAL PROFESSION.

The medical profession have not yet learnt the full value of the Exerciser, which can only be done by a careful study of its practice. There are many ways of using it, but the right way is the best, and produces the best results; still, they recognise its value, and use the machine at home as a household remedy for the acquisition of health, and recommend it to their patients both for its health-giving properties and also in cases of disease. The hospitals now are fitting up special rooms with Exercisers, in which the patients are treated successfully; and as time goes on, and doctors become more proficient in the science of the right method of localisation of muscular movements, they will more and more find out the hygienic value of the system, and still greater successes will be the result.

The specialists in deformities were the first to find out the immense value of the Whitely Exerciser; and in looking over the list of names of doctors who have purchased the machine, we find general practitioners, consulting surgeons and physicians, and specialists well represented. Doctors specially recommend the use of the Exerciser for

the treatment of spinal curvatures and other deformities; in cases of weakness of the heart, lungs, and digestive organs; in nervous disorders; and for the cure of obesity.

CHAPTER X.

TREATMENT OF WEAKNESSES OF THE VITAL ORGANS BY EXERCISE.

THERE are already many systems in vogue for the treatment of internal disease by muscular movements, and we cannot do better than quote an article that appeared in the *Lancet* recently, entitled "Notes on the Treatment of Heart Disease by Mechanically-resisted Movements," by Dr. George Herschell, Physician to the National Hospital for Diseases of the Heart, &c.: "Putting aside as a point yet to be settled whether the baths in use at Nauheim, and their imitations in this country, have any real curative power in diseases of the heart, the evidence in favour of the practical utility of the resisted movements in selected cases is overwhelming. My experience, however, leads me to believe that we can obtain better and more constant results by substituting a mechanical resistance to the movements for that offered by a nurse. My reasons are the following:—1. A mechanical resistance is more scientific, inasmuch as it admits of being exactly measured. 2. It is more constant, as it does away with the personal equation of the operator. It is quite impossible, even after long practice, for a nurse to be certain of offering the same amount of resistance to movements on each

occasion, for, as a matter of fact, she does not even know how much force she is really exerting. 3. With the aid of mechanical resistance, we can improve very much upon Nauheim movements, which I venture to assert are by no means the best which can be devised for the purpose. 4. The exercises which can be used when the movements are mechanically resisted are more rapid in their action than those used in the Nauheim treatment. As an example, I have convinced myself, by actual observation and experiment, that five minutes' use of a certain simple movement will temporarily increase the circumference of the arm of a healthy muscular man by one inch. This it can only have accomplished by withdrawing blood from the general circulation into the tissues of the limb.

"As mechanically-resisted movements produce a more marked effect upon the patient than the Nauheim ones, even greater precautions must be taken in administering them. It must be made an absolute rule that the exercises are never to be given, except in the presence of a medical man, until the treatment has so far advanced that it has been ascertained not only that it is doing good, but also how much mechanical work the patient can stand. . . . . During the exercises he will be on the watch for, and note any symptom, such as dyspnœa, lividity, pallor, faintness, or giddiness, which would show that the exercises were not

suitable, or were being executed too rapidly. It is this necessity, that the patient should be under the observation of a properly-trained clinical observer, which makes it impossible that a treatment of this kind can ever safely be administered by a nurse—at any rate until the patient is well advanced towards recovery, and it has been definitely ascertained what exercises he can stand with impunity. Then, and then only, it may be admissible to allow the movements to be performed without the presence of the medical attendant."

This valuable testimony of a specialist in heart disease is quite sufficient proof of the efficacy of the exercises; but we should like to add a few remarks upon what is known as heart affections as opposed to heart disease. There are many sufferers from bad circulation, due to the defective action of the heart, from weakness or flabbiness of its muscular walls; they consult their medical man, who tells them that their hearts are sound but weak; they must, therefore, be careful not to overwork themselves in any way, and to remember that their heart is not strong, otherwise, they may, from over-exertion, such as when rushing for a train or omnibus, faint away, or perhaps die from sudden stoppage of the heart's action. Another class of people suffer much anxiety from a perturbed action of the heart, due to sluggish digestion, or to a nervous disorder, although the heart itself is perfectly sound. Lastly, there is the heart that is overstrained, by having to work against a circulation which

has become congested in the small blood-vessels of the tissues and in the veins, from want of sufficient muscular exercise, or has been dilated and weakened by the overstrain of athletic contests in the past. We find in nearly all these cases that, not only the heart, but also the muscular system generally is flabby, and that as the muscular system improves in tone, so does the heart.

A flabby heart is far more common than a diseased heart, and in its worse form—namely, when it becomes encased by thick layers of fat, and even its muscular fibres themselves converted into fat—is perhaps even more dangerous. The worst cases are due to an excessive accumulation of fat throughout the system, or to a degeneration of the tissues from a poorly nourished blood, as in the anæmia so commonly seen in overworked and underfed young girls.

The flabby heart is certain to improve when properly treated by systematic muscular movements, but in all cases the patient must be under the guidance of a medical man, at any rate for a time.

By the scientific use of the Exerciser, muscular movements can be so finely adjusted that the very smallest amount of stimulation can be brought to bear upon the heart when necessary, which is of the greatest importance in the worst cases. For instance, by letting the patient, in a recumbent position, exercise one of the smaller muscles, the extra work imposed upon the heart is very slight; and if the

effect of the exercise upon the patient is carefully watched by a medical man well versed in the science of muscular movements, a point can be reached each day when the heart will be just stimulated sufficiently to improve in tone, and finally, after much care and patience, even the most flabby hearts can be restored to a healthy condition by steadily increasing the daily work.

The object of quoting a severe case is to prove the fact that the Exerciser can be advantageously used, even in cases where the heart is too bad to admit of the exercise of the large muscles of the leg that are used in walking, for the larger the muscles that are brought into play, the greater the strain thrown upon the heart; note the amount of discomfort that the possessors of flabby hearts suffer when ascending a flight of stairs; by putting into severe action such large muscles, a great demand is made upon the work of the heart, an attack of palpitation and shortness of breath results, and the heart is still further damaged.

Exercise, by improving the circulation and the tone of the lungs, the digestive organs and the nervous system, necessarily improves the condition of the heart indirectly.

The contracted and unexpanded chest (so frequently produced by habits of stooping over the work, either at school or in the office; by bad postures, assumed while standing, walking, playing games, or perhaps more particularly while cycling) is, in every way,

conducive to lung troubles; whereas it must be at once patent to anyone that, by the special breathing and chest exercises which will be described in the Second Part of this book, the chest can be enlarged in all directions, and its deformities rectified; the lungs, thus enlarged, improve in tone, and are more capable of purifying the blood, by performing their double function of supplying oxygen to, and removing carbonic acid gas from it.

The little bacilli which are the cause of consumption cannot live on healthy lung; the only cure for this terrible disease is to get the lung tissue into a healthy state by fully developing its capacity, so that fresh air is allowed to enter even the most remote air cells. Undoubted cases of cures of consumption in its early stages by means of fresh air have been recorded, and we could give instances of marvellous results from the use of the Exerciser; for consumptive lungs are not only diseased, but are also contracted, and their capacity for breathing diminished. An increase of the breathing power is beneficial to the lung tissue, and destructive to the bacilli. But why wait for consumption to lay hold of the weak lung? Far better strengthen the lung by suitable exercises, and so ward off the disease altogether. Patients do not inherit consumption itself, but the tendency to acquire it; that is, their lungs, if neglected, are especially likely to form suitable soil for the tubercle bacillus; many die yearly

from consumption who might, had they taken care of themselves by attending to the laws of health, have lived to a good old age.

It is the boast of gymnastic instructors and teachers of physical culture that they can cure indigestion, yet it is not at all uncommon to find them suffering from indigestion themselves; the fact being that they do not know enough about the subject, and, consequently, ignoring the different forms of indigestion, make the broad statement that exercise of the abdominal muscles will cure indigestion, which is absurd. There are some forms of indigestion that exercise would make much worse, and exercise of the abdominal muscles improperly conducted or overdone would be of no avail in the treatment of the very common form of indigestion, well-named sluggish digestion, which is most amenable to treatment by suitable exercise.

Sluggish digestion is so frequently associated with all kinds of nervous disorders and morbid ideas that it will save much repetition if the two affections are taken together. One of the chief causes of sluggish digestion is the complaint called "nerves," and one of the chief causes of "nerves" is sluggish digestion; so they act and re-act, the one on the other, and the commonest causes of both are:—

1. Insufficient bodily exercise and timely rest.
2. Over-anxiety and worry, due to the enormous commercial and other

competitions, and exacting educational examinations of the present day, or even sometimes to the need of some occupation, and self-made worries, from not having worry enough.

3. Dress, in so far as it interferes with the proper exercise of the body, and hampers the functions of its organs.
4. Defects in other organs, chiefly brought about by ignorant inattention to a good system of health culture.

The nervous system, which includes the brain, the spinal cord and the nerves, keeps all the functions of the body under proper control, and makes them all work together in harmony; it presides over all our actions, and is the seat of all our sensations. Directly we, by neglect, let any part of ourselves get out of working order, extra work is imposed upon our nervous system, and after a time it becomes strained and overwrought. The nervous system itself, like the rest of the body, is entirely dependent upon the circulation of the blood for its nourishment, and as the blood gets its nutriment from the digestive organs, you can easily see how a defective digestion must upset the nervous system; and when the nervous system is upset, the control of the digestive and other organs is damaged, and they accordingly work improperly. What is the meaning of the terms "nervous debility," "hysteria," "hypochondriasis,"

"nerves," and the many other names given to this fashionable disease? It is a condition of the nervous system in which, from a weakened state of the organs of our body (including the nervous system itself), brought about by improper living, we are unable to restrain our emotions and feelings, and so we become timid and irritable, unable to curb our tempers, imaginative and fanciful, disinclined for exertion or work, always craving for sympathy, and last, but by no means least, constantly thinking that we are suffering from a unique disease that doctors cannot find out; and, finally, we take refuge in the most largely advertised nostrums and quack remedies. And yet our organism is crying aloud for what the great Sydenham, on his deathbed, described as the three great physicians—air, water, and exercise; or, in other words, for a good supply of oxygen, and for a relief from the accumulation of waste products, both on the outside and inside of the body. In these days of keen competition and exacting educational examinations, the nervous system is constantly breaking down, because people imagine they cannot spare the time to attend to their health. Let them try the result of a daily use of the Exerciser in a well-ventilated room, and find out for themselves the great benefits to be derived therefrom, and how much better will be their work, and how much more enjoyable their life altogether.

The worried man seeks rest for his nerves

in sleep, but he takes his troubles to bed with him ; his brain is full of blood, and although he may be drowsy, yet he cannot get a refreshing sleep ; a few energetic muscular movements made just before getting into bed will draw the blood from the brain into the muscles, and sweet, refreshing sleep will be induced.

Enough has already been said about the effect of exercise in removing the waste products from the body, to prove how the excretory organs, the skin, lungs and kidneys, depend upon active muscular movements for their efficient working. In fact, we do not think we exaggerate when we say that exercise, carried out on scientific lines, actually cleanses the internal economy, and that it is just as important to keep the internal fittings of the human machine clean as it is its surface. An engine clogged up with its refuse matters would soon prove incapable of performing the work demanded of it, and so it is with the body.

CHAPTER XI.

THE TREATMENT OF DEFORMITIES BY EXERCISE.

An excellent book, entitled the "Relief and Cure of Spinal Curvatures," by Dr. P. Lewis, of Folkestone, has just been published, in which he thoroughly deals with the subject of the muscular as opposed to the mechanical treatment of deformities. We shall quote largely from this book, and here take the opportunity of stating that we are greatly indebted to Dr. Lewis for supplying us with the plates illustrating this chapter.

It does not come within our province to write a long treatise on deformities and their treatment; those who wish to study the subject should read the book above mentioned. All that we wish to do is to point out that by a localisation of the proper muscular movements, as designed for the Exerciser, the best results will be obtained, and that the principle of supporting the weakened part by braces or other forms of mechanical appliances is, in most cases, harmful, as it still further weakens the very muscles that ought to be strengthened by imposing forced inactivity upon them.

Many a rickety child has been allowed to grow up and carry through life a limb, chest or back ill-shapen and distorted, because the muscular system has been neglected.

Curvature of the spine is caused by occupations which demand work from one side of the body and not from the other, by bad positions assumed at the desk of the office or school, and by deformities of other parts of the body (chest, legs, etc.); the strong muscles pull the spine out of shape, which shape can be restored in the young by developing the weak muscles.

Girls at school, whose only means of counteracting the evils of long periods of sitting at their work is the two-and-two daily walk, or the weekly calisthenic class, are most likely to contract spinal curvature, which, as a matter of fact, is much more common in girls than in boys; because boys have so many outdoor games wherein they can exercise their muscles, and in this way often correct the inclination to deformity.

Dr. Lewis says: "It is a generally accepted fact that curvatures of the spine are due to 'weak muscles.' It most commonly happens that a curvature is first noticed at those periods of life when growth is proceeding most rapidly, viz., from 5 to 7 and from 12 to 17 years of age. . . . . From the examination of a number of cases, it is found that curvature is most common in those individuals who are generally described as 'overgrown.' . . . The result of the long indoor hours to which children are often subjected, especially at home, is feeble muscular development. Glancing for a moment at the physiology of muscles, we find that the

muscles have a very important rôle in the organism in connection with both heat and nutrition. As regards heat, they have been called the furnaces of the body, and they have been estimated to produce about four-fifths of the heat necessary to maintain life. If the muscles be feeble, the temperature is subnormal, and nutrition is thereby depressed. Further, without muscular exercise, respiration and circulation are slowed, and therefore the respiratory and circulatory organs are badly developed. The muscles, too, have important functions in connection with the assimilation and conversion of food within the body. They help, also, in the elimination of waste products. In the want of muscular development and its results exist important causes of defect of nutrition. The two things, then, work in a vicious circle. Defect of nutrition is a cause of undeveloped muscles, and undeveloped muscles are a cause of defective nutrition. But it is not likely, nor is it a fact, that one tissue only would suffer from the abnormal environment; all the other tissues of the body must suffer directly as well as indirectly. The sight is often defective; there is little mental energy; the patient suffers from anæmia, rheumatic neuralgia, the so-called 'growing pains,' dyspepsia, and, very commonly, menorrhagia. Weak muscles mean, too, weak bones, and weak bones involve weak ligaments. The big bones are soft and spongy, and are easily bent or moulded gradually by the constantly

applied pressure of bad positions; the ligaments are soft and easily stretched by the same cause. The whole body is, in fact, 'jerry-built.' Not only is the whole structure without strength, but the physiological whitewashing, painting, and papering are badly done, and the sanitary arrangements are defective. An interesting fact, too, is that these patients have often been allowed to acquire fads about their food.

"The internal organs become more or less affected by spinal deviations, even from the first. Thus, the habitual stooping, which is so active a cause of curvature, cramps the lungs, especially the upper lobes, and interferes with free normal respiration. From want of free normal respiration, the whole body suffers; still more is this the case when the whole chest has become distorted and cramped, and the lung space permanently encroached upon. In advanced cases the heart, too, suffers interference from displacement, either of itself or of the direction of its chief vessels, in addition to the inconvenience which it suffers from the inefficient respiration. Intercostal neuralgia, from pressure on the nerves, may occur when the ribs become pushed together.

"The abdominal organs suffer in the same way from interference with the chest organs, and possibly uterine displacements have their predisposing, if not exciting, causes in the direct or indirect effects of muscular weakness. It may here be remarked that

the author has frequently been able to relieve his patients from the necessity of wearing uterine supports, by substituting a course of medical exercises.

"The Greeks early recognised the value and importance of physical culture. Plato, more than any other Greek writer, in his immortal work, 'The Republic,' sets forth the necessity, and forcibly illustrates the value of this form of education. . . . . It is due to the disregard of this first rule of health, preached hundreds of years ago, that one so frequently meets with cases of spinal curvature at the present time. It is frequently argued that if spinal curvature is due to weak muscles only, then any measure which tends to make the muscles strong should cure curvature. In very early cases—especially in those where it is now one side, now the other, where, in fact, the muscles have not, or have not long got into the habit of allowing the spine to deviate only in one direction—treatment founded upon this idea very often succeeds. It is with these cases that the non-medical practitioner, the masseuse, the rubber, the professor of So-and-So's system of movements, the special gymnastic master, *et hoc genus omne*, make their reputations. Where, however, the case is worse than this, their treatments are often failures, or make the patient worse, for their exercises and movements are mostly symmetrically performed, or when asymmetrically, no notice is taken of rotatory changes. Without medical

training, and often even with it, it is impossible to estimate the relative amounts of rotatory and lateral changes in the different regions of the spine. Without this knowledge, the best and quickest treatment cannot only not be devised, but any treatment must be haphazard, and liable to be frequently a cause of serious damage.

"Mr. Bernard Roth is the surgeon who has, however, done most to put the cure of spinal curvature by exercises on a firm basis. So little, however, have his principles permeated general surgical practice, that cases of spinal curvature are not admitted into London hospitals.

"Besides relieving the deformity, muscular exercise has many striking effects on the body generally. Exercise increases the metabolism of the muscular tissues, and, therefore, the amount of heat in them. They then consume more oxygen, making the blood more venous and less arterial. This causes an increase in the movements of respiration, which, in its turn, increases the flow of blood through the lungs, and quickens and strengthens the heart-beats. The same changed condition of the blood also causes the blood-vessels in the skin to dilate, and the perspiration glands to secrete. Regular exercise, which systematically does all this, day after day, must, and indeed does, have a most important effect upon general health.

"Thus the general nutrition of the body is improved, partly from the increased demand

tor food, partly by the increased elimination of waste products, and partly by the raised body temperature.

"The muscles have been called the 'furnaces of the body.' If the muscles are ill-developed, the furnaces are burning low, and the body machine cannot do its proper amount of work. Exercise causes the furnaces to burn up again, and restores the efficiency of the machine. The beneficial effects which most persons feel after a course of Swedish movements, massage, or other form of muscle-developing exercises, are partly due to these causes.

"Equally important too are the effects on the circulation and respiration. The strengthening of the heart muscle is not the least important part, and the effect of the increased respiratory movement on the development of the chest is most marked. An inch or more in circumference of the chest is very quickly gained by simply practising deep respiratory movements. This increased chest development has a very marked remedial effect on spinal deviations. In fact, the efficacy of the different systems of movement cures may be gauged by their relative effects in enlarging the thorax.

"It is quite impossible for those who are not in the habit of using a good system of physical development in the treatment of disease, to appreciate how great a change such a measure brings about in these muscleless people. The results, without any other treatment, often

appear to the uninitiated to be most wonderful.

"Exercises, it may be repeated, have the following results:—

1. Great improvement in the general health.
2. They remove one cause of the deformity, viz., weak muscles.
3. They develop the thorax, the contraction of which is part of the deformity, and at least cure so much of the general abnormality.

"The exercise treatment is required through all stages of the disease, and must be kept up afterwards, to prevent any tendency to recurrence. It is necessary as a preventive measure in children of weak muscular development, and it is equally necessary for an adult with a confirmed incurable curvature, to preserve the general health.

"And here it may be as well to mention, since it is a matter of great importance, that the development of the muscles by means of exercise does not necessarily imply 'violent' exercises. Many parents associate the idea of gymnastics with violent exertion.

"Before practising the exercises, however, the patient and one of his relations, if the patient is a child, should be properly instructed by a skilled person, *e.g.*, a doctor, or a gymnastic master. More rapid progress is, however, made by having one of the daily lessons performed at a gymnasium, even where not more of the apparatus than would

be fitted up in the patient's home is used . . . but the whole cure can be done at home, and need not interfere with lessons or any other business. All the exercises herein detailed are meant to be performed with slowness, ease and grace, without jerking or holding the breath. No exercise is to be continued after the first feeling of fatigue is induced.

"A visit to the medical gymnasium, which Folkestone most fortunately possesses, dispels at once the delusion that gymnastics must necessarily imply violent exercise.

"The modern gymnasium offers facilities for building up the body, which are not excelled by any other system of exercise. The introduction of the new developing appliances has opened up the possibility of the gymnasium to many to whom it was before of doubtful value.

"In improving the deformity by the use of muscular exercises, we also incidentally bring about an usually very great improvement in the general health. So much is this the case, that very many practitioners are now in the habit of prescribing a course of medical movements or gymnastics for the cure of depressed vitality. It is important, however, that the exact cause of the depressed vitality should be accurately made out and treated. Thus, if dyspepsia were the cause, it would obviously be better to investigate its etiology than to trust to its accidental cure by the gymnastics. Frequently the dyspepsia of young curvature patients is due to a deficiency in the teeth, to errors or fads of diet, or to

insufficient clothing. In these cases the improvement caused by the movements would not be permanent, unless the cause of the dyspepsia were at the same time removed.

"Games, undoubtedly, have an influence in the formation of spinal deviations, so much so, that many—though forms of muscular exercise—have to be prohibited, or at least modified for curvature patients. Most games are, more or less, right-sided ones, tending to draw back the right arm, and by excessive use of the right arm to produce a convex right dorsal curvature. Nevertheless, by making these games left-handed instead of right-handed, many of them may be rendered not only not injurious, but useful adjuncts to ordinary treatment. As stooping has been shown to be a cause of curvature, this must always be borne in mind in permitting or prohibiting this or that special game.

"Batting at cricket has a tendency to rotate the spine so as to bring the right shoulder forward, but it also gives considerable exercise to the left arm, in batting at any rate. In fielding there will naturally be a tendency to assume bad positions unless the fielder is in a position where balls frequently come. Bowling exercises a very large number of muscles, but it is of course another instance of a one-sided exercise.

"Golf, again, has the same tendency to rotate the right shoulder forwards. The left arm, however, comes in for such an amount of exercise in using the club as is sufficient to

prevent a lateral curvature. In 'putting' a good deal of stooping is necessary. This, however, is harmless if the player is careful to assume an erect position when the putting is done. The variety in the different actions in the game, interspersed with the gentle walking exercise in open spaces which the game entails, makes golf an ideal form of exercise for those for whom greater feats of strength are undesirable.

"Hockey is really a more violent form of golf, in which the rests are shorter and fewer. Patients with right dorsal convexities should play hockey left-handed, if they are strong enough to indulge in the game at all.

"Football is hardly a game for persons with spinal curvature. This is unfortunate, because it is practically a symmetrical exercise, the only asymmetrical part being the kicking, which is always done with the right leg. The Association game is even more symmetrical, as the left leg takes almost equal share with the right in the game. Both forms are, however, far too violent forms of exercise for persons with weak muscles, weak bones, and weak ligaments.

"Fives, rackets, tennis, and Badminton are all right-arm exercises, with a tendency to form right dorsal convexities. By using the left arm instead of the right, this deformity, if present, may be very much improved. For patients who for any reason cannot go to a gymnasium, the writer has long been in the habit of prescribing left-handed Badminton.

This can easily be played in any fair-sized room, over a piece of tape or string fixed from one wall to another, or even from one chair to another. The writer can speak highly of it as a very useful form of corrective exercise.

"Bowls, quoits, skittles, all right-handed games, may, too, be useful if reversed.

"Fencing is an excellent exercise, conducing not only to the cultivation of a correct attitude in standing, but it also conduces to rapidity of motion, decision, and steadiness of nerve. It should be of great use in those of feeble muscular development in which a curve has not yet appeared. The pupil should, however, be taught to fence equally well with either right or left arm.

"Sculling is a good symmetrical exercise for those who have been previously strengthened by a course of medical exercises. It is, however, an exercise to be indulged in moderately, and care must be taken that it is done properly, or there is a tendency for sculling to produce kyphosis. Rowing with a single oar tends to produce a dorsal convexity on the side away from that on which the oar is used. This was notoriously the case with the slaves on the triremes of Ancient Rome.

"Swimming, when the breast stroke is used, is also a good exercise towards the end of a course of treatment. Not only does the bathing have a good tonic effect on the system, but the exercise is a good corrective one, tending, among other good effects, to counteract the kyphosis.

"Before concluding the subject of the influence of the various games, a word or two must be said about bicycling. There can be no doubt that, for most young persons, bicycling under certain conditions is an ideal form of exercise. It is ideal, because it can be made to combine change of scene and out-door life with a minimum of exertion. For those engaged in educational excesses or in mental work, it forms a more or less efficient corrective, giving a maximum of fresh air, with sufficient exercise in a comparatively short time. There are, however, certain necessary conditions to fulfil in order to ensure this very beneficial result. The muscles should have attained a certain degree of development, or if not, the cycling should be used most gradually until this degree of development has been reached. At first the cyclist should never ride until he or she is out of breath. On the first symptoms of breathlessness, the cyclist should dismount and rest. The amount done per day should be very strictly limited at first. Thus the muscles and the circulation will be gradually strengthened, and the over-strain and cardiac dilation will be avoided. In following this rule, the cyclist will soon find that the distance traversed before breathlessness occurs, rapidly increases, until it gradually recedes into the dim distance. It is very important, too, that the cycle should not be too heavy. Many of the bicycles sold, especially ladies' cycles, are far too heavy, and the writer has seen

bicycles weighing nearly 40 lbs. being ridden by quite young girls. The maximum weight for an adult of not more than 12 stone should be 30 lbs., and very much less if the rider's weight be under 8 stone. Under no circumstances should boys and girls ride bicycles made for adults, not only on account of the weight, but also because of the possibility of strain or injury to internal organs. Young people should never ride hills of any length or magnitude, and with regard to the distance travelled, they should never cycle more than three times the distance they would be able to walk. The rate, too, should not exceed seven or eight miles an hour. The position of the saddle is of the utmost importance. The saddle should be comfortable, should not be small, and should never give rise to "saddle soreness." It is impossible to recommend any special saddle; each rider must find out for himself the saddle which for him fulfils these conditions. Generally a narrow peak with a broad seat will be best.

"The 'cyclist's back,' which is a kyphosis of lumbar and dorsal vertebræ, is caused by having the saddle too far back and the handles too low. The saddle and handles should be in such a position that the attitude of greatest comfort is the erect position with the spine showing its normal curves. This is mostly insured by the handle bars being on a level with the hip-joints, *i.e.*, about two inches higher than the saddle, and by the handle ends reaching to the junction of the lower

Effect on Spine of "Scorcher's Attitude."

Effect on Spine of having the Handles of the Bicycle too far forward.

To show effect on Spine of writing at too low a table (exaggerated).

To show Rotation of Spine from Sitting Cross-legged (exaggerated).

one-fourth of the femurs with their upper three-fourths. Cycling should not be indulged in soon after a meal, nor for females at those periods when much exercise is generally forbidden.

"Recently, in the *Medical Annual* of 1897, Dr. Otto Kiliani has recommended sloping the seat and raising one handle bar as a means of curing scoliotic deviations, and has given figures showing the effect of these alterations. It is to be noted, however, that the photographs are necessarily taken with the patient at rest. Cycling being a symmetrical exercise, it seems reasonable to suppose that, when in motion, the correction tends to take place automatically if the above instructions are accurately carried out.

"For a pure kyphosis, the saddle should be brought nearer the handles, and for a pure lordosis, further away.

"In the foregoing remarks the writer would not wish to be understood as recommending or depreciating any of the above recreations for *healthy* persons. The observations are only meant to point out those which are unsuitable for curvature patients, and how others must be modified, if they are permitted at all, to those who are under treatment for spinal deviations."

Knock-knees, bow legs, wry neck and other deformities can be successfully treated by the proper muscular movements, which also applies to stiff joints, the result either of an injury or rheumatism; for by the movement

cure, the joints are made moveable, the ligaments are loosened, and adhesion disappears.

Bone-setters have, in years past, derived large incomes from the treatment of stiff joints. Sprains, fractures, dislocations, inflammation of joints, after treatment by rest in splints, generally end in stiff joints, because a plastic fluid exudes, and glues, as it were, the soft structures firmly together by the formation of bands of adhesions; movement of the stiff joints stretch these adhesions, and cause pain and swelling. Bone-setters forcibly break through these adhesions, which give way with a sharp snap, and the patients, hearing the noise, are quite prepared to accept the explanation that the snap is due to a dislocated bone being returned to its socket; and, furthermore, believe that they have been treated wrongly by their medical man for a sprain instead of for a dislocation.

Dr. Wharton Hood advises that any adhesions that may have formed should be immediately broken down by manipulation, and then that the joint should be freely exercised so as to prevent their re-union.

CHAPTER XII.

HEALTH IN THE CITY.

By the late Dr. Mannington Caffyn.

Is health in the City possible? is probably, where five millions are concerned, one of the most potent questions of the age, and the nature of the reply rests entirely upon the individual's definition of the meaning of the word health. If by health one means the health of the Greek, who,

> "Subtle and strong,
> Lived at full speed, and whose life was a song;"

if by health one means the "wild joy of living," characteristic of youth and freedom from care; then we have no hesitation in saying that health in the City is not possible.

There is no discomfort, said a leading surgeon recently, like that of knowing that one has anything, even a little toe; and the whole tendency of a City life is to breed what one would like to call local self-consciousnesses.

The rarest thing to meet nowadays is a Man—the representative quiet republic of the man himself—what one shakes hands with is the organ for the time being predominant; our yellow-skinned friend, who dined out last night, and is worried with West Australians, talks to you through his liver; the next man's brain is on the box seat and governing the

self of him; another leads you round the corner to prate of his indigestion — his stomach's tyranny—and so on and on the whole man; the wholesome republic has ceased to be; it has been, if one might so express oneself, knocked on the head by the office stool.

It is not necessary, even in the City, to point out that the muddle of design in which the close of this century finds itself, is contradictory to those laws of development which one must suppose were originally laid down as the lines upon which human development should proceed. But what one has to admit is that this artificial condition of things is here, and established, and the problem of the wise physician of to-morrow will be how to circumvent this artificiality.

As we have said, the idea of physical growth was one of a pure republic, in which every organ should have its voice, but not be predominant; but the fact to-day is that the majority of men have drifted from this wholesome republic into an unwholesome monarchy in which some organ is king.

For years past, society has been making the effort to regain a wholesome physique; the gymnastic classes, the athletic clubs, the golf craze, and last of all, the bicycle mania, have all been unconscious efforts on the part of men to get back to a natural condition of living.

Man was not so much born to sorrow as he was to work; every detail of the build of him,

his wondrous system of irrigation, the need of him in Nature and Nature's need in him, all proclaim this fact with no uncertain voice, and yet work, as work, and for work's sake, has in the upper half of society (if one may so call it) died out—we have become artificial, through no fault of our own, it is true, but the exigencies of social life have so insisted.

The crudest knowledge of physiology lends proof enough, not of the advisability, but of the absolute necessity of constant work for the men who would enjoy life, and escape the manifold death traps that lie in wait for those who neglect Nature's first laws.

There is something intensely pathetic in the picture of the healthy young public school giant who, with the help of uncles, has succeeded to the office stool of the uncles' stockbroker, which, henceforth, is to be his throne of decrees (type-written). In him, the sap of manhood is still rampant, but circumstances are against him ; his breakfast is bolted, and he is catapulted through some miles of bad gas on the Underground, to find himself ejected at last into the rabbit warren of the City. The wonder is that life at all, under these circumstances, is possible.

But, as we have said, these abnormal conditions obtain, and the problem to-day is how best to deal with them. The banker's clerk, the stockbroker's assistant, the draper's young man, and the barmaid are essential factors in the economy of the world as it is at present.

Man has been called a tool-using animal, but, as a matter of fact, he is simply a machine for the conversion of food into something; but for the conversion of foods, every physiological law teaches us that the getting rid of waste is essential, and to this City life is entirely antagonistic.

The stock salutation of the City is, "How are you?" (as though one's physical condition were always in the balance), and the stereotyped reply is, "Off colour." A giant stands at the corner of Throgmorton Street, frock-coated and tall-hatted. A scientist, glancing at him, says, "You should be felling timber, my friend; be tilling the earth, that she may laugh in harvest." But no; his days are spent: one-fourth in the rabbit-hutch of an ill-ventilated office, one-fourth in the tussle with the City lunch, one-fourth in the effort to sell shares of little value, and the rest in harangues with the woman at home, who is waiting for him; and with this, health is supposed to be possible. The whole idea is absurd. Nor has medicine helped us much. There is wanting the heroism, or even common truthfulness necessary to say, the under-current of the barbarian in you, which is essential to your health, you have neglected, and the big liver you come to talk about is the consequence. The horse that took you to the station this morning has no liver; nor the coachman that drove you; nor nervous systems beyond their needs.

The comedy needs no dilating on, and the

world has itself to thank for it. They were told many years ago, and authoritatively, that the proper study of mankind was man; and yet the Board School child, who can prate to you of the moon and its craters, Saturn and its satellites, has no more idea of his own internal economy than has the North American Indian of the "X" rays.

Or again, though instances are tiring, take—that is not hard to find—our friend with the liver. The reply, if you notice it, to your "How are you?" is a tap over the right waistcoat pocket with the second finger of the right hand, and the implication is that something is wrong underneath (*i.e.*, with the liver). Your sister's husband has been unbearable in the house of late. Thunderstorms have been prevalent, and she taps her stays. He, poor fellow! has a liver out of order. The returned Indian official, dissatisfied with his club dinner, swears at the waiter; the bank-manager curses his cabman; and they are livers, all of them—livers; and the mere tapping of the seat of the organ is supposed to be sufficient excuse for any eccentricity.

It is the double life that kills. If one could be content to live alone the life of the beaver, that of a storer of food only, or, as in the case of the City man, a maker of money merely, some health and some sort of quietude of living might be possible; but your City man is an effort to combine both the life of

pleasure with the life of accumulation, and the admixture is incompatible.

After all has been said and done, the fact remains that health is a question of irrigation —of residue—of waste. We said that man was a converter of food into something; the conversion is a matter very much of temperament, or it may be necessity, but the residue and its riddance is a matter of forgetfulness, and ill-health is the consequence. The great Abernethy, standing with a gluttonous patient over a pail in an ante-room, into which surreptitiously had been emptied a fac-simile of his dinner, is, if one thinks of it, a splendid object lesson, we will not say of Aldermanic life, but of City over-indulgence.

The man with the big appetite is the bank with a good reputation, and the deposits flow in accordingly; but—and here's the rub—an abundance of deposits is not all that's necessary for a good going concern. Whether the concern be the bank or its manager, there must be outlets for the use of these deposits, wholesome methods for their employment; the man with his lymphatics full of unused food is an exact analogy to the City bank with its cellars full of unused bullion, and we doubt if the discomfort resulting to the proprietors is not as great as that of an institution verging towards bankruptcy.

The analogy of the bank and its manager might be continued to any length, the similarity of deposit is so marked, the convertible security, such as, in the case of the

manager, a wholesome lunch; in the case of the bank, coin of the realm; and again the inconvertible security, such as, in the case of the bank, deeds to be locked up; in the case of the manager or his client, a surfeit of lobster mayonnaise.

Yes, men are banking concerns, and the one suffering from an over-draft is the lean, anxious man, who walks with his head down, his brow furrowed, and his hands in pockets that are empty; and he, on the other hand, whose cellars are full, is of great girth, wealth of waist, a certain bagginess of trousers, and a manner that irritates.

And the remedy for all this should not be hard to find; the last one possible is the "similia similibus curantur" of the faddist (we are not referring to homœopathy); that good can follow an application of artificiality to artificiality, even when the greatest of names are appended thereto, is an absurdity. We cannot—and here we have to become dictatorial—we cannot hope to lift men out of ill-health by the giving of poisons. That the administration of poisons is sometimes not only wise but an absolute necessity, there can be no doubt; the prescribing of opium, strychnia, and arsenic have undoubtedly saved thousands of lives; but we are dealing now with natural methods of restoring Nature's health in Nature's way, and, given only a moderate knowledge of natural laws, the road to this goal should be sufficiently obvious.

We have said something, and hinted more,

of the physiology of waste, and hereabout the whole question, not only of ill-health, but of ill-temper, we would like to add domestic discord and thoughts of suicide crystallise themselves.

The gouty man with a swollen toe has urates there—the swollen toe is the symptom; the man with the pimple on his nose has pus beneath it—you know it by the swelling; and the man that swears at his cook has impeded lymphatics, and you know it by the swearing.

Could anything be more unnatural than the devoting of an afternoon to the Turkish bath, where a man's waste may be removed artificially—waste that in the normal state should have come away normally, as in the rest of animal life; he lies down, and the shampooer unloads him—unloads him of waste material, half-digested food, retained secretions, and all the débris of living, which for weeks past have spoilt his work, injured his temper, and made home-life unbearable. By the natural law, the débris of living should be removed by the activity of living; but the process is no longer practicable, in that we *have* developed into a nation of shop-keepers, and men are growing fat.

The alliance of laughter and the first-cousinship of merriment to a freedom from food waste is a fact of which society is not aware. The conditions of City life have made it imperative that the City man should return to his home loaded with alcoholic waste and undigested food,

and the misery of his existence is the consequence.

But enough of causes. One has to ask one's self firstly, if it is possible to lift things back on to their old basis; and in the event of this being impossible, what alternative can be adopted? In reply to our first question, there is only one answer possible. We do not think the present Government, with its gigantic majority, could drive business men back to the felling of timber; nor will all the preaching in the world, nor even the potency of printers' ink, frighten men from the haunts where money-making is easy and rapid. As we have already said, the condition that is has to be.

There is, perhaps, nothing more interesting in the whole world of social life than the feeble effort on the part of feeble men to make for health. There is an under-current of knowledge (intuition, perhaps, one ought to call it) that is a part of each man's heredity. Take, for instance, the question of drinking. To suppose, as the abstainers would have us believe, that a man drinks in order to poison himself is absurd. No sane man does anything, especially so potent a thing as drink, without an object, and the object of the man who drinks is to get life back to him—artificial life, we admit, but still life.

The feller of timber, the tiller of soil, the mechanic pushing his plane, gather health in the effort; but there is no muscular effort about the office stool, nor is there honest

sweat in Throgmorton Street; and hence the ill-health of the City man, and the big liver that has become proverbial.

We have spoken of the tendencies to alcohol, and the "frequent nip" forms so omnipotent a feature of City life that one must dwell upon it for a moment. Let us throw the light of theories upon a fact. A sells to B a parcel of shares, and, happy in the bargain, invites B to moisten the contract. They adjourn to the nearest bar, and order their special form of alcohol. A takes gin and peach, B a whisky and soda. Now, at the back of the drinking of both A and B lies a tremendous scientific fact. Both have gone through an era of some excitement during the last half-hour; both are, to that extent, bankrupt of nerve force; and to both it is necessary to get back to a condition of solvency—nerve solvency. If A asked B to lunch, and gave him a steak or what not, solvency lies at the distant end of digestion. It would be hours before results came, and comparable to giving the bankrupt an unnegotiable bill at three months when he wants coin of the realm, and alcohol is coin of the realm. It may be, and is, the ammunition of spendthrifts, but the fact remains that, for a time, it lends potency.

Alcohol in any form, whether it be the workmen's beer, the woman's gin, or the more expensive luxuries of the rich, is simply, if one thinks of it, the panacea of modernity. The race to the North by the competing rail-

way companies involved a condensation of fuel; the tremendous pace of this century has resulted in a special selection of foods, and alcohol, although not a food in the lasting sense of the word, has been found by experience to be so immediately useful that necessity has made a habit of it. At the same time, we do not contend that the mere pace of living is entirely responsible for the drinking habit of to-day; mis-begetting has much to answer for.

To be carnally-minded results, too frequently, not in death, but in birth. The echo of passions begotten of over-indulgence reverberates down through one's posterity, and the thirst of the father becomes the heritage of the child, unto the third and fourth generation.

And now by way of restoration—lifting our old humanity back on to the lines laid down for it, about the time the foundations of the hills were laid. There is no happiness for the unhealthy, nor holiness (the three words, by the way, are synonymous); at the same time, it is obviously impossible to accommodate the existing condition of living to the old order of things, but it is equally impossible to neglect with impunity those fundamental laws upon which the old condition of things was founded. Man's thinking capacity, his whole brain work, is merely the outcome of good physical development, and comes normally, as the flower to the plant that's well manured; the struggle for existence has

resulted in a neglect of that physical development, and our consulting rooms are filled with these victims of forgetfulness. Improved dwellings for the poor is the chronic cry of the blatant reformers; but no thought is given to the City clerk, whose one necessity is a back garden to cultivate, that may grow, not geraniums, but health and strength in the tilling; the labourer may want more ventilation, his children more sleeping room, his wife a larger drying area, but the clerk's necessities are as imperative; his white face, drooping shoulders, and contracted chest, are eloquent in their cry, not for artificial methods, but for the physical exercise which has been the foundation of all great men and all lasting races.

CONTENTS OF PART II.

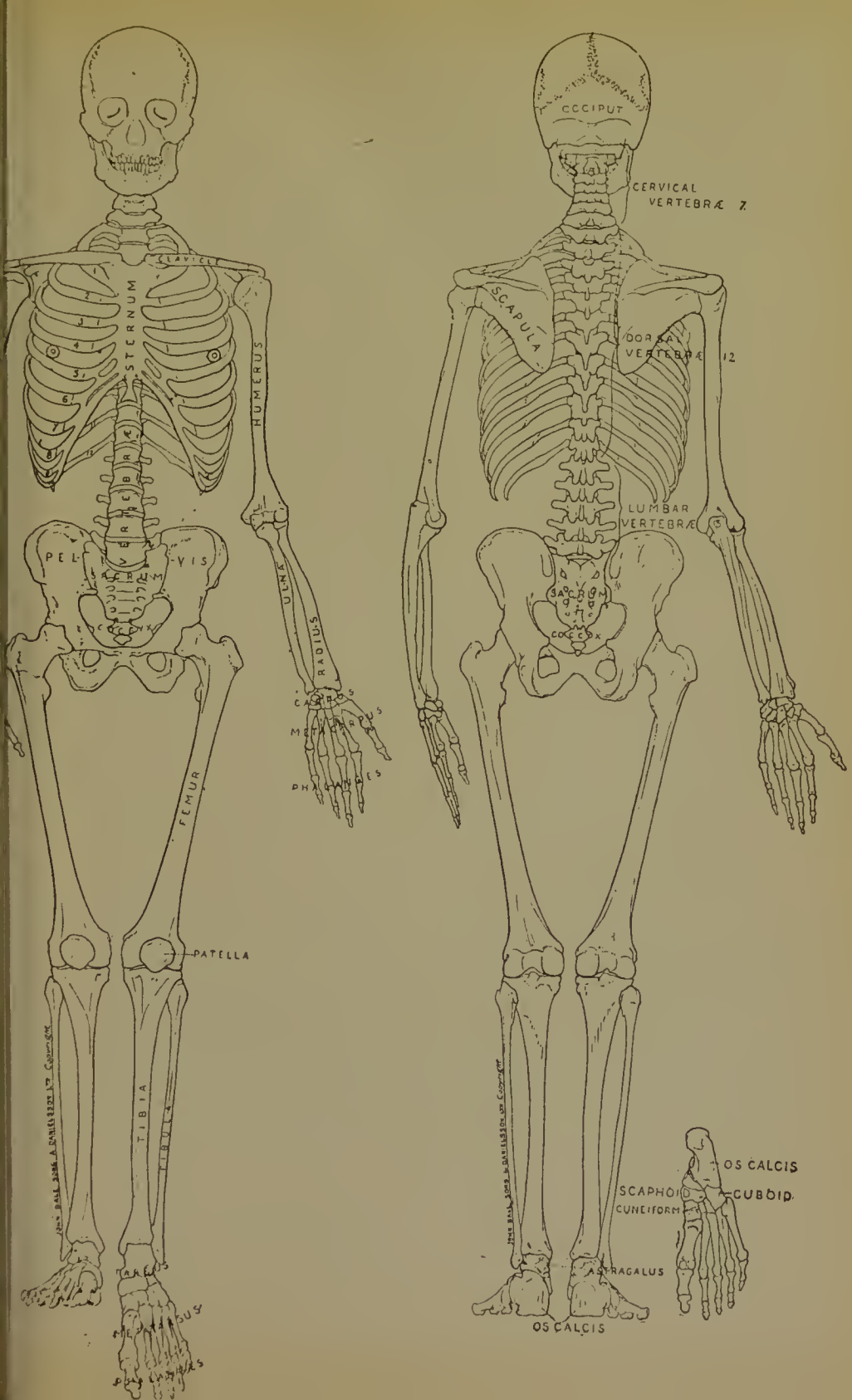
Part II.

THE BONES, JOINTS, AND MUSCLES.

To acquire a sufficiently sound knowledge to enable you to work upon scientific lines, it is necessary that you should be acquainted with at least a rough knowledge of the origin and insertion of the chief muscles, in order to understand their action and the exercises necessary for their correct development. We shall, therefore, first of all, describe the skeleton, and then give the names of the bones to which the muscles are each attached, always taking the regular anatomical text-books (Gray and Quain) as our authorities, both as to the attachments of the muscles and as to their action. The great difficulty in writing a popular treatise on a scientific subject is to be accurate, and, at the same time, clear and free from technicalities. We shall do our best to overcome these difficulties, and, as the busy man wishes to acquire his knowledge in the quickest possible time, we shall make our account as short as possible.

THE SKELETON.

There are about two hundred bones altogether in the skeleton which forms the framework of the body, and gives the height and breadth to the human figure. The bones of men are larger, and the prominences and ridges to which the muscles are attached are more pronounced than those of women, and the larger the bones the larger the muscles. The bones are covered by muscles, and, by the actions of the muscles upon the bones, the different movements of our bodies are made at the joints, which represent different kinds of levers. We need only describe one half of the body, as one half is almost exactly like the other half. The limbs consist of the arms and legs, which have many points of semblance; there is only one bone (the humerus) between the shoulder and elbow, and only the femur between the hip and the knee; between the elbow and wrist are the radius and ulna, and between the knee and the foot, the tibia and fibula—in front of the knee is a flat bone (the patella), forming the knee-cap. There are eight small bones in the wrist and the ankle respectively. The five bones between the wrist and the fingers are called the metacarpals, and those between the ankle and the toes, the metatarsals; the fourteen bones forming the fingers and toes are called phalanges.


CLAVICLE
STERNUM
HUMERUS
ULNA
RADIUS
PELVIS
FEMUR
PATELLA
TIBIA
FIBULA
OCCIPUT
CERVICAL VERTEBRÆ 7
SCAPULA
DORSAL VERTEBRÆ 12
LUMBAR VERTEBRÆ 5
SACRUM
COCCYX
OS CALCIS
SCAPHOID
CUNEIFORM
CUBOID
ASTRAGALUS
OS CALCIS

The skull and face are made up of twenty bones, and all, except the lower jaw, are firmly joined together to protect the brain, which is contained in the skull.

The spine consists of twenty-six bones, called vertebræ, named according to the region in which they are situated—cervical, or neck; dorsal, or back; and lumbar, or loins. There are seven cervical vertebræ, twelve dorsal vertebræ, and five lumbar vertebræ. The two lowest bones are called the sacrum and coccyx. The spine supports the skull and the trunk, and encloses the spinal cord, from which the nerves pass out to the muscles of the body.

To each side of the twelve dorsal vertebræ are joined the twelve ribs—the same number in the female and the male. Many of them reach to the sternum (or chest bone) in front, and so form the cavity of the thorax, or chest.

The arms are fixed to the top of the sternum by the clavicle, or collar bone, and the scapula, or blade bone of the back.

Fixed to the spine below is a hollowed bony cavity, or basin, called the pelvis, to which the legs are attached. The bones of the pelvis are the sacrum and coccyx behind, and the os innominatum (usually divided into the ilium, ischium, and pubes) at each side.

THE JOINTS.

Two large bones enter into the formation of the shoulder joint, the humerus and scapula, and are so shaped as to form what is called a ball and socket joint, which allows movement to take place in all directions. The hip joint is very like the shoulder joint, but is stronger, and does not move so freely. It is formed by the femur and the os innominatum.

The knee and elbow joints are hinge joints, which only allow movement to take place forwards and backwards; the humerus, ulna and radius form the elbow joint, and the femur and tibia the knee. There is a separate joint between the radius and humerus, which allows of movements called supination (the palm of the hand directed upwards), and pronation (the palm directed downwards). The patella protects the front of the knee joint. The eight bones of the wrist and the ankle form rather complicated joints.

THE MECHANISM OF JOINTS.

The bones which enter into the formation of a joint are peculiarly shaped, so as to admit of the movements belonging to the particular

joint; and in addition to this, are covered by a smooth, shiny-polished substance, called cartilage. The cartilage is kept constantly moist by an oily fluid, which has been called the joint oil.

The bones are held together by strong tissue—somewhat like the tissue forming the tendons of muscles—called ligaments, which completely enclose the joint, and prevent the joint oil from escaping. Some joints, such as the knee, have strong bands, or ligaments, passing from one bone to the other, inside the joint as well as outside, to strengthen it.

Call in at a butcher's, and ask him to show you the joint of a recently-killed animal, and carefully note its structure. Examine the shape of the bones, next the cartilage covering the bones, which will be quite moist if the joint has only just been opened; and lastly, note the strength of the ligaments, which have been cut through in order to expose the inside of the joint. By doing this, you will fully realise how beautifully Nature has constructed this piece of perfect machinery, guarding it against loss of substance by providing a natural oil for its lubrication.

THE MUSCLES.

COVERING the skeleton, and filling in the spaces between the bones, are the two

hundred and forty named muscles of the human body. Each muscle possesses the power of contraction and its own special action whereby the manifold movements of the body are performed.

A muscle consists of two parts, a broad fleshy part called the belly of the muscle, and a strong fibrous tissue called the tendon or leader. The body made up of muscular fibres is the part that contracts. The tendon is the part that joins the muscle to the bones, and may be long or short according to circumstances, so as to allow the body or contracting part to be placed where there is most room for it—note the position in the forearm of the muscles that move the fingers.

The muscle proper is made up of numerous bundles of little fibres; each little fibre is elastic and can contract, and the strength of the muscle depends upon the size and number of these minute microscopic fibres and their elasticity.

Each bundle is enclosed by fibrous tissue, and it is possible for a muscle to be enlarged by a development of this fibrous tissue if the muscle is overworked, or worked under unfavourable conditions; that is, when poorly supplied with blood. The extra fibrous tissue takes up valuable space that would otherwise be filled with muscular fibres, and the resulting muscle loses a proportionate amount of its strength and elasticity, is slow in action, and is hard when relaxed.

Each bundle of fibres is supplied with

minute blood vessels and a small nerve—the artery brings the nourishment to the muscle, the vein removes the waste products, and the nerve gives to it its power of contraction. When we wish to effect a certain movement, we send an impulse from the brain which passes through the spinal cord and the nerves going to the particular muscles involved. If the nerves going to the muscles, say, of the leg, be cut through, the muscles of the leg become helpless, the control over them is lost, because their communication with the brain is stopped, and we say that the limb is paralysed.

If the blood supply to a muscle is stopped, it gradually loses its power of contraction, and on the other hand, the better the supply of blood to a muscle, the more work it is capable of doing. The amount of blood supplied is increased by muscular activity, so much so, that it is possible, by making the muscles of the upper arm contract vigorously against a moderate resistance, to increase the measurement of the upper arm one inch, the increase being due to the extra amount of blood that has been drawn into the limb by the activity of the muscles; a great increase in the heat of the limb is also noticeable, for muscles are the chief heat-producing organs in the body, which is another reason why it is necessary to exercise them regularly.

In Landois and Stirling's book on Physiology, it says:—"Muscles are most perfect machines, not only because they make the most thorough

use of the substances on which their activity depends, but they are distinguished from all machines of human manufacture by the fact that, by frequent exercise, they become stronger, and are thereby capable of accomplishing more work (Du Bois-Reymond)."

We mean by contraction that the muscle gets shorter in length, and so pulls upon the bones to which it is attached, and brings them nearer together by moving them one upon the other at the joints. We speak of these attachments as the origin and insertion of the muscle, the origin being the point from which the muscle acts, and the insertion the part which is acted upon.

A muscle, by shortening in contraction, becomes broader, thicker, and harder in consistence, and it gives a false impression of being larger, but, as a matter of fact, if anything, it is a little smaller in bulk, because the fibres are more closely packed together.

LUIS J. PHELAN

1891.

—

Age, 25 Years. Weight, 13 Stone 10 lbs.

LUIS J. PHELAN,
1898.
Age, 32 Years. Weight, 10 stone 3 lbs.

Gold Medal, publicly awarded by Sandow to Luis J. Phelan, April 5th, 1897.

LUIS J. PHELAN.

MR. LUIS J. PHELAN, who was publicly awarded by Sandow a Gold Medal, in 1897, for the best development acquired by scientific physical culture, has drawn up a photographic chart showing sixty positions of the exercises by which he attained his perfect development. It is the result of six years' study, and personal experience of the benefits and advantages derived from the localisation of the proper exercise on one group of muscles at a time. It will be noted, on referring to the Chart, that perplexing technical terms have been simplified as much as possible, and the particular part of the muscle which is exercised by the movement is clearly indicated by small arrows.

Mr. Phelan has never used dumb-bells, nor any heavy device to exercise, and has confined himself to the use of the Exerciser, with the above satisfactory results.

Those who have been fortunate enough to see Mr. Phelan, when exhibiting at different places in England and America, will have seen what we consider to be our beau ideal of health and strength, with all his organs sound and his muscles full-sized (not hypertrophied), firm, but perfectly soft when relaxed, full of fine elastic fibres, active and strong. He can, of course, perform feats of strength, but as this is not his aim, and is contrary to our

principles, he seldom indulges this side of his powers. He always advocates the use of light elastic resistance, which is the sure and safe method of keeping the body healthy, and always fit and ready for all rational forms of exercise. He has entirely devoted himself to the science of muscular development, and is determined to acquaint the public with the secret of his perfect health. Ever boastful of the change in the contour of his body, for before using the Exerciser he was very stout and podgy, with very indifferent health, it is hard to believe that the photograph taken of him seven years ago, when he weighed 13 st. 10 lbs., and the photograph of himself at the present time, weighing 10 st. 3 lbs., are of the same man.

ENLARGEMENT OF THE CHEST.

Exercises Nos. 1 and 2 are for the special purpose of enlarging the chest, and so the capacity of the lungs, and should be carefully attended to by all who have any weakness of the lungs, either inherited or acquired, or who are predisposed to strumous disease or consumption. Not only does the lung become larger, but its expansion, elasticity, and power are increased, and air is made to enter even the most remote air cells. The blood is thus most thoroughly purified as it

passes through the lungs by losing its carbonic acid gas and by taking oxygen from the air contained in the lungs. It is quite possible to gain an increased measurement of two or three inches in the circumference of the chest; thus not only is the figure improved, but what is of far greater consequence, the lungs are made stronger, and much better able to resist diseases. Dr. Morgan writes: "An addition of three inches to the circumference of the chest implies that the lungs, instead of containing 250 cubic inches of air, as they did before their functional activity was exalted, are now capable of receiving 300 cubic inches within their cells. The value of this augmented lung accommodation will readily be admitted. Suppose, for example, that a man is attacked by inflammation of the lungs, by pleurisy, or some one of the various forms of consumption, it may readily be conceived that in such an emergency, the possession of enough lung tissue to admit 40 or 50 additional cubic inches of air will amply suffice to turn the scale on the side of recovery. It assists the patient successfully to tide over the critical stage of his disease."

This of course only applies to an increased measurement acquired by a healthy development, not to the expansion obtained by over-exertion, in which the air cells are stretched or even ruptured by the strain put upon them, and a condition called emphysema induced.

All medical authorities agree that fresh air has the most beneficial effects on diseased

lungs. Inasmuch as pure air is necessary for the well-being of the lungs, it will be advantageous here to insist upon the exercise room being thoroughly ventilated; and that the greatest amount of good may accrue to the operator, it is well always to have the window open while exercising, but at the same time draughts must be avoided.

Students of elocution and singing will be greatly benefited by these exercises, for the lung is the motor power, as it were, of the voice, and strength of lung means also strength of voice.

There are other special breathing exercises marked with an asterisk, in all of which the breath should be alternately taken into and ejected from the lungs. Inhale strongly through the nose whenever the arms are raised, and exhale when they are depressed.

The muscles that are attached to the humerus and the ribs raise the chest when the arms are raised, and so increase the capacity of the lungs, an action which is made much more effective if a strong inhalation is taken at the same time. Artificial respiration depends upon this principle. The patient is placed in a recumbent position, the arms are raised above the head, whereby the capacity of the chest and lungs is increased, and air rushes into the lungs to fill up the extra space, the arms are then lowered and pressed against the chest walls, so as to expel the air again, and the apparently drowned have often been restored to life by a repetition

of these movements at the rate of about eighteen movements per minute, or in other words, by making as good an imitation of the natural respiratory movements as is possible.

Respiration consists of two movements—inspiration and expiration. Air enters and leaves the lungs when the cavity of the chest is increased or diminished in size. The cavity of the chest is increased by the contraction of the intercostal muscles (which are attached to the ribs, filling up the spaces between them), which raise the ribs; or by the contraction of the diaphragm (which forms the muscular partition between the chest and the abdomen). Women, when breathing, make more use of the intercostals; men, of the diaphragm. Other muscles which help to raise the ribs also assist respiration.

THE DIAPHRAGM.

The diaphragm is attached to the spine behind, to the lower six ribs at the sides, and to the bottom of the sternum in front. It rises high up into the chest cavity, forming an arch over the organs contained in the abdominal cavity, especially over the stomach and liver. When it contracts, the arch becomes flattened out, the abdominal organs are pressed downwards, and the chest is expanded vertically. The descent of the

diaphragm, by pressing upon the liver and stomach, stimulates them, and accelerates the circulation of blood through them.

In expiration, the cavity of the chest is diminished by the return of the walls of the chest, and of the displaced organs, to their original position, by means of the elasticity that they possess.

The nose is so constructed as to act as a filter, as it were, for the air that passes through it. Dirt and impurities contained in the air become entangled in the fine little threads that everywhere line the internal membrane of the nose. It also causes the air to be heated as it passes over the hook-shaped bones, which are arranged like hot-water coils.

To make the description of the localisation of muscular movements complete, it is quite necessary to give the origin, the insertion, and the principal action of the chief muscles that are employed in the movements. Although only the principal muscles will be mentioned, it must not be forgotten that others take part in each exercise. The names of the bones themselves are printed in large type, and the special parts of the bones to which the muscles are actually attached, are printed in smaller type alongside, so that the rough anatomy can be taken in at a glance, and the busy man thus spared details that might be irksome to him ; whereas the man of leisure, who has the time to master the subject, will be able to do so. The more the subject is

studied the more interesting and the more important it becomes.

PECTORALIS MAJOR.

The Pectoralis Major (or chest muscle) is a large triangular-shaped muscle, situated in the front of the chest; and when well developed, gives to the chest and bust a fine appearance. It is divided, for practical purposes, into an upper and lower part. It is one of the chief muscles passing from the ribs to the arms.

Used		in Exercises 3, 4, 6, 7.
Origin.	**Clavicle.**	Sternal half of its anterior surface.
	Sternum.	Its anterior surface.
	Ribs.	The cartilages of the 1st to 7th ribs.
Insertion.	**Humerus.**	The anterior ridge of the bicipital groove.
Principal Action.		Draws the arm across the chest.

LATISSIMUS DORSI.

The Latissimus Dorsi muscle is a large, somewhat triangular-shaped muscle, situated at the side of the back, where it can easily be felt below the armpit as it passes from the spine to the upper arm.

Used		in Exercises 5, 10.
Origin.	**Spine.**	Spinous processes of Dorsal Vertebræ (7th to 12th). Spinous processes of Lumbar Vertebræ (all). Spinous processes of Sacral Vertebræ (1 and 2).
	Ilium.	Posterior half of outer edge of crest.
	Ribs.	Lower four.
Insertion.	**Humerus.**	Bottom of bicipital groove.
Principal Action.		Draws the arm down across the back.

DELTOID.

The Deltoid (or shoulder muscle) is a fan-shaped muscle, covering the shoulder, and for practical purposes is divided into three parts : Anterior, Lateral, and Posterior. When well developed, it gives to the shoulder a fine, broad and rounded appearance.

Used		in Exercises 5, 6, 7, 8, 9, 10, 11, 12, 28, 29, 30.
Origin.	**Clavicle.**	Outer third of its anterior border.
	Scapula.	Anterior edge of Acromion Process, lower edge of spine.
Insertion.	**Humerus.**	Middle of the outer surface.
Principal Action.		Lateral Deltoid. Raises arm laterally from body. Anterior Deltoid. Raises arm forward. Posterior Deltoid. Raises arm backwards. The Anterior Deltoid acts in conjunction with the Pectoralis Major. The Posterior Deltoid acts in conjunction with the Latissimus Dorsi.

TRICEPS.

The Triceps (or back upper arm muscle) has three heads ; is situated at the back of the upper arm, and can easily be felt when the elbow is straightened.

Used		in Exercises 8, 13.
Origin.	**Scapula.**	Below the Glenoid cavity (long head).
	Humerus.	Posterior surface (outer head above groove). Posterior surface (inner head below groove).
Insertion.	**Ulna.**	Posterior surface of the Olecranon Process.
Principal Action.		Straightens the elbow joint and keeps it stiff.

RHOMBOIDEUS.

The Rhomboideus consists of two muscles, situated between the spine and the scapula, called Rhomboideus Major and Rhomboideus Minor.

Used		in Exercise 9.
Origin.	**Spine.**	Ligamentum Nuchæ. Spines of 7th Cervical, and 1st to 5th Dorsal Vertebræ.
Insertion.	**Scapula.**	Vertebral border.
Principal Action.		Draws scapula backwards towards the spine.

TRAPEZIUS.

The Trapezius is a large muscle situated at the back of the neck, and in the upper half of the back between the spine and the scapula.

Used		in Exercise 9.
Origin.	**Skull.**	Inner third of superior curved line of the occipital bone.
	Spine.	Ligamentum Nuchæ. Spines of 7th Cervical and all the Dorsal Vertebræ.
Insertion.	**Clavicle.**	Outer third of its posterior surface.
	Scapula.	Superior edge of the Acromion Process. Superior edge of the spine.
Principal Action.		Draws the head backwards. Draws the shoulders backwards. The Trapezius, continuing the action of the Deltoid (which ends when the humerus is raised horizontally to the height of the shoulder), raises the upper arm from the horizontal position to the perpendicular.

ERECTOR SPINÆ.

The Erector Spinæ is the large muscle situated at the lower end of the back; it keeps the spine erect, as its name implies. Opposite the last rib it divides into two parts; the outer part is called the Sacro-Lumbalis, and the inner part the Longissimus Dorsi.

Used		in Exercises 11 and 12.
Origin.	**Spine.**	Spinous processes of Sacrum. Spinous processes of Lumbar Vertebræ. Spinous processes of Dorsal (10th to 12th) Vertebræ.
	Ilium.	Posterior part of inner lip of crest.
Insertion.	**Ribs.**	Angles of 7th to 12th (Sacro-Lumbalis). Between angle and tubercle of 7th to 11th (Longissimus Dorsi).
	Spine.	Transverse processes of Lumbar Vertebræ (Longissimus Dorsi). Transverse processes of Dorsal Vertebræ (Longissimus Dorsi).
Principal Action.		Maintains the spine in the erect position. Raises body from a stooping to an erect posture.

STERNO-MASTOID.

The Sterno-Mastoid is the large muscle seen in the front of the neck when the head is bent forward to one side. It connects the lower part of the skull with the upper part of the chest.

Used		in Exercises 15 and 16.
Origin.	**Sternum.**	Upper and anterior part.
	Clavicle.	Inner third of the superior border.
Insertion.	**Mastoid Process.**	Outer surface.
	Occipital Bone.	Outer two-thirds of the superior curved line.
Principal Action.		Bends head upon chest, when both muscles act together. Bends head sideways if acting singly.

MUSCLES OF THE ABDOMEN.

The chief muscles of the abdomen are the oblique (external and internal) and the straight (rectus). These muscles form the walls of the abdominal cavity, stretch from the chest above to the pelvis below, and are named according to the direction of their fibres—oblique and straight. Inasmuch as the abdomen contains the chief organs of digestion—the stomach, the intestines, the liver, and the pancreas—the exercise of the abdominal muscles is of the greatest importance. We find in works on treatment by massage (or passive movements of muscles), that great attention is bestowed upon the abdominal muscles for the cure of indigestion and the reduction of obesity; and seeing that good results can be obtained by passive movement of these muscles, how much better must be the results gained by the active movements of the muscles themselves. The muscles, by their movements, press upon the organs in the abdomen, and gently stimulate their action; thus sluggish digestion (perhaps the most common form of indigestion, whose symptoms are popularly attributed to the liver, and form the basis for the advertisements of numberless quack remedies), will gradually be made to disappear, and with it the layers of fat that frequently accumulate in the abdominal walls.

These muscles, too, play a very important part in the diaphragmatic breathing of singers and speakers, and their anatomy, action and control should be carefully studied by all students of voice production.

Perhaps the easiest way of becoming familiar with these muscles is by examining one's own abdominal walls, when lying in bed. Feel the ribs above, and the bones of

the pelvis below, and then the muscles filling up the space between them; the Rectus will stand out prominently in front directly you begin to raise the body from a recumbent to a sitting position, and when well developed, will appear to be in separate rolls, for the muscle is divided into several parts by transverse intersections. Raise the body sideways, and the oblique muscles become prominent at the sides, showing the digitations attached to the ribs between the digitations of the Serratus and the Latissimus Dorsi muscles.

Used in Exercises 17, 18, 19, 20, 21, 22, 23.

Rectus Abdominis.

Origin.	**Pubes.**	Crest and Symphysis.
Insertion.	**Ensiform.**	Appendix.
	Ribs.	Cartilages of, 5, 6, and 7.

Obliquus Abdominis Externus (or External Oblique).

Origin.	**Ribs.**	Inferior borders of eight lower ribs.
Insertion.	**Ilium.**	Anterior half of external lip of the crest.
	Aponeurosis.	Which meets its fellow muscle at the middle line of the abdominal wall, where it is called the Linea Alba. The lower border of the Aponeurosis, stretching from the Ilium to the Pubes, is called "Poupart's Ligament."

Obliquus Abdominis Internus (or Internal Oblique).

Origin.	**Poupart's Ligament.**	Outer half.
	Iliac Crest.	Anterior $\frac{3}{3}$ of middle lip.
	Fascia Lumborum.	
Insertion.	**Ribs.**	Cartilage of three lower.
	Aponeurosis.	Linea Alba.
	Conjoined Tendon.	Front of Pubes.

Principal Action. The abdominal muscles, by their straight and oblique fibres, bend the abdomen forwards; by their transverse and oblique fibres, they constrict the size of the abdomen, and so press upon the contents of the cavity, and thus help to raise the abdominal organs to their original position after they have been depressed by the lowering of the diaphragm in breathing.

FLEXOR MUSCLES OF THE FORE-ARM.

The Flexor Muscles of the Fore-arm consist of the flexors of the wrist and of the fingers, named according to their action: the radial and ulnar flexors of the wrist—Flexor Carpi Radialis and Flexor Carpi Ulnaris—and the superficial and deep flexors of the fingers—Flexor Sublimis Digitorum and Flexor Profundus Digitorum. All the flexors, except the deep flexor, are very prominent on the inner side of the fore-arm.

Used		in Exercise 24.
Origin.	**Humerus.**	Internal condyle.
Insertion.	**Metacarpal Bones.**	Base of 2nd (Flexor Carpi Radialis). Base of 5th (Flexor Carpi Ulnaris).
	Phalanges.	Last phalanx of each finger (Flexor Profundus Digitorum). Middle phalanx of each finger (Flexor Sublimis Digitorum).
Principal Action.		Bend wrist. Bend fingers.

EXTENSOR MUSCLES OF THE FORE-ARM.

The Extensor Muscles of the Fore-arm are the extensor muscles of the wrist (named like the flexors)—Extensor Carpi Radialis and Extensor Carpi Ulnaris—and the common extensor of the fingers—Extensor Communis Digitorum. They are situated at the back and outside of the fore-arm, where they can be easily felt by extending the wrist.

Used		in Exercise 25.
Origin.	**Humerus.**	External condyle and ridge above it.
Insertion.	**Metacarpal Bones.**	Base of 2nd and 3rd (Extensor Carpi Radialis). Base of 5th (Extensor Carpi Ulnaris).
	Phalanges.	Last and Middle (Extensor Communis Digitorum).
Principal Action.		Straighten wrist. Straighten fingers. N.B.—The flexors are on the inner side and front of the fore-arm, and the extensors are on the outer side and back of the fore-arm.

BICEPS.

The Biceps is the muscle of the front upper arm, and comes at once into great prominence when the elbow is bent. It has two heads.

Used		in Exercises 26 and 27.
Origin.	**Scapula.**	Tip of Coracoid Process (short-head) Top of Glenoid cavity (long-head).
Insertion.	**Radius.**	Into tubercle on the inner and back part of its neck.
Principal Action.		Bends elbow and supinates fore-arm.

QUADRICEPS EXTENSOR.

The Quadriceps Extensor, the large muscle of the front of the thigh, consists, as its name implies, of four parts —the Rectus Femoris, the Vastus Externus, the Vastus Internus, and the Crureus).

Used		in Exercise 31.
Origin.	**Ilium.**	From the Anterior Superior Spine (Rectus). From the groove above the Acetabulum (Rectus).
	Femur.	From its external, internal, and anterior surfaces from the Trochanters above to the lower fourth below. (The Vastus Externus from the external surface; the Vastus Internus from the internal surface; and the Crureus from the anterior surface.)
Insertion.		Patella.
Principal Action.		Straightens the knee. Supports Femur on Tibia in standing.

THE ADDUCTOR MUSCLES.

The chief adductor muscles of the thigh, situated on its inner side, are the Adductors Longus, Brevis and Magnus, and the Pectineus.

Used		in Exercise 32.
Origin.	**Ilium.**	Ilio-pectineal line (Pectineus).
	Pubes and Ischium.	Rami (Adductors).
Insertion.	**Femur.**	Just below small Trochanter (Pectineus) Internal Surface. (The three Adductors).
Principal Action.		Adduct the thigh powerfully (especially used in horse exercise). Carry thigh across opposite side.

SARTORIUS.

The Sartorius (or tailor's muscle, so named because it is the muscle that allows him to assume his peculiar attitude when sitting at work), crosses the inside of the thigh, and is the longest muscle in the body.

Used		in Exercise 33.
Origin.	**Ilium.**	The Anterior Superior Spine and half the notch below it.
Insertion.	**Tibia.**	Inner surface at its upper end.
Principal Action.		Crosses one leg over the other.

ABDUCTOR MUSCLES.

The chief Abductor Muscles of the thigh are the three Glutei—The Gluteus Maximus, Medius and Minimus. They are situated at the back and outer side of the upper part of the thigh, forming the prominence of the Nates.

Used		in Exercise 34.
Origin.	**Ilium.** **Sacrum.** **Coccyx.** **Sacro Sciatic Ligament.**	
Insertion.	**Femur.**	Great Trochanter.
Principal Action.		Abduct thigh. The Gluteus Maximus is chiefly used in helping to raise the body from a stooping position.

ILIO-PSOAS MUSCLE.

The Ilio-Psoas Muscle, consisting of two parts, arises from the side of the spine, and the inside of the pelvis is inserted into the upper part of the femur, and is chiefly engaged in supporting the pelvis on the femur, and so maintaining the erect position,

Used		in Exercise 35.
Origin.	**Spine.**	Sides of bodies of 12th Dorsal and all Lumbar Vertebræ, and from their inter-vertebral substances. (Psoas).
	Ilium.	Whole of its inner surface. (Iliacus).
	Sacrum.	Base. (Iliacus).
	Ilio-Lumbar Ligament.	(Iliacus).
Insertion.	**Femur.**	Lesser Trochanter and part below it.
Principal Action.		Bends thigh. Assists abdominal muscles in raising the trunk from the recumbent position.

BICEPS.

The Biceps is the chief hamstring muscle, and, like the Biceps of the arm, has two heads. It can easily be felt at the back of the thigh when the knee is bent.

Used		in Exercise 36.
Origin.	**Ischium.**	Back of the Tuberosity.
	Femur.	Outer lip of the Linea Aspera.
Insertion.	**Fibula.**	Upper and outer part of the head.
Principal Action.		Bends the knee.

RULES TO BE OBSERVED.

In order to attain the best results, it is absolutely necessary to assume a correct posture before exercising. Advance either foot and bend the knee, keeping the other foot firmly planted upon the ground, with the leg straight, just as is done in boxing and fencing. Keep the head erect, shoulders drawn back, chest well out, and the abdomen drawn in. Concentrate the work upon the particular muscle or muscles that it is intended to bring into play (without swaying the body, and thereby using other muscles).

In a few cases it is better to keep the heels together, with the feet at an angle of 90° ; in others to adopt a striding position, with the feet at an angle of 90°, and from 6 inches to 1 foot apart.

Stand perfectly firm, as if about to withstand a resistance.

Work not only with the will, but also with intelligence.

Learn thoroughly the object of the exercise, and take great pains that you work in the

right way, otherwise you will be disappointed in your results; the small amount of brain power that you will have to expend in mastering the science of the proper development of muscles will be amply repaid, not only by results attained, but also by the increased pleasure and interest that you will take in your work.

Make up your mind as to the length of time that you will daily devote to your health, and let nothing interfere with it. Do not begin by over-doing the exercises, and then gradually tire of them. It is far better to devote even a very little time regularly than to work longer at irregular intervals—15 minutes a day is quite enough for the preservation of health.

While exercising keep the power of recuperation always in mind; work each group of muscles until you can distinctly feel them, and do not go beyond this point. Healthy development and recuperative power will grow apace, and firm but fine agile and elastic muscles, such as are suitable for all the requirements of every-day life.

Use a machine that is suitable to your strength; the strongest machine does not necessarily produce the strongest development; the fiercest movements either cannot be made, or will cause a strain if the resistance is too great. Very few men are strong enough to get full benefits from the use of an athlete's machine. We aim for the healthiest muscle, but at the same time we gain the strongest.

THE ANATOMICAL CHART.

Exercise 1. (B†)

Fig. 1. Position.

Back to Exerciser.
Advance one leg and bend the knee.
Handle in each hand, palms upwards.
Arms fully extended downwards and forwards.
Hands about a foot in front of hips.
Cords under arms on each side of waist.

Exercise 1. (Continued).

Fig. 2. 1st Movement.

Carry the hands backwards to a point about a foot behind the hips

Broadening the Chest.

Fig. 3. 2nd Movement.

Circle the hands upwards and as far backwards as possible to a point straight above the head.
Thrust the chest well forward, and inhale deeply as the arms are raised.
Return to original position and repeat.
Keep the elbows stiff throughout the movement.

Exercise 2. (B+).

Fig. 4. Position.

Back to Exerciser.
Advance one leg and bend the knee.
Handle in each hand, palms forward.
Arms fully extended upwards straight above head.
Hands about six inches apart.

Deepening the Chest.

Fig. 5. Movement.

Circle the hands forwards and downwards in front of the chest the cords should rest between the shoulders and the neck.
Return to original position and repeat.
Keep the elbows stiff throughout the movement
Inhale deeply as the arms are raised.

Exercise 3. (B†).

Fig. 6. Position.

Back to Exerciser.
Advance one leg and bend the knee.
Handle in each hand, palms inwards, knuckles touching.
Arms fully extended to the front on a level with the shoulders.

Pectoral Muscles.

Fig. 7. Movement.

Circle hands outwards and backwards as far as possible on a level with the shoulders.
Return to original position and repeat.
Keep elbow stiff throughout the movement.
Inhale as the arms go back.

Exercise 4. (*S*).

Fig. 8. Position.

Left side to Exerciser.
Advance right foot and bend the knee.
Both handles in left hand, palm downwards.
Arm fully extended horizontally outwards on a level with the shoulder.

Pectoral (Lower Part).

Fig. 9. Movement.

Circle the hand downwards and forwards to the front of the left hip.
Return to original position and repeat.
Keep the elbow stiff, chest well protruded, and body still.
Use right arm in turn.

Exercise 5. (*S*). Latissimus Dorsi and Teres Major.

Fig. 10.

Position. Right side to Exerciser.
Advance left foot to side, and bend the knee. Both handles in right hand, palm downwards. Right arm fully extended horizontally on a level with the shoulder.

Movement. Circle right hand downwards to the back of the right hip. Return to original position and repeat. Keep the elbow stiff throughout the movement. Use the left arm in turn.

Exercise 6. (B). Deltoid and Pectoral.

Fig. 11.

Position. Back to Exerciser. Advance right leg and bend the knee. Both handles in left hand, palm forwards. Arm fully extended horizontally on a level with shoulder as far back as possible.

Movement. Circle hand forwards to the front of body. Return to original position and repeat. Keep elbow stiff throughout the movement. Use the right arm in turn.

Exercise 7. (B†)

Fig. 12. Position.

Back to Exerciser (handles at bottom).
Advance one leg and bend the knee.
Handle in each hand, palms upwards, knuckles touching.
Arms fully extended horizontally forwards on a level with the shoulders.

Deltoid, Pectoral, &c.

Fig. 13. Movement.

Circle arms backwards as far as possible.
Return to original position and repeat.
Keep elbows stiff throughout the movement.
A valuable exercise for keeping the shoulders in a good position.

Exercise 8. (F|).

Fig. 14. Position.

Face to Exerciser.
Advance one leg and bend the knee.
Handles in each hand, palms downwards.
Arms fully extended horizontally forwards a little higher than the shoulders.

Triceps, &c.

Fig. 15. Movement

Circle hands downwards and backwards to the side of the hips.
Return to original position and repeat.
Keep the elbows stiff and chest well protruded throughout the movement.
By turning the palms inwards as they pass the hips, and by carrying the arms as far back as possible, the upper part of the Triceps and the posterior parts of the Deltoid are brought into full action.

Exercise 9. (F1).

Fig. 16. Position.

Face to Exerciser.
Advance one leg and bend the knee.
Handle in each hand, palms inward, knuckles touching.
Arms fully extended horizontally forwards on a level with shoulders.

Trapezius Rhomboids, &c.

Fig. 17. Movement.

Circle hands outwards and backwards, keeping them on a level with the shoulders
Return to original position and repeat.
Keep elbows stiff and body still throughout the movement.
Keep the arms at a high level for the upper part of the Trapezius, and at a lower level for the middle part, and for the Rhomboids.

Exercise 10. (F†).

Fig. 18. Position.

Face to Exerciser.
Advance one foot and well bend the knee.
Handles in each hand, palms outwards.
Body bent forward.
Arms fully extended horizontally forwards on a level with shoulders.

Latissimus Dorsi, &c.

Fig. 19. Movement.

Circle the hands outwards and downwards towards the hips, keeping the elbows stiff. Curl up the arms and strike out forwards as in swimming (the breast stroke).
Return to original position and repeat.
Keep the body still throughout the movement.

Exercise 11. (F†).

Fig. 20. Position.

Face to Exerciser.
Heels about six inches apart and level, feet at an angle of 90°.
Handles in each hand, palms downwards.
Body bent forward, knees straight, arms fully extended horizontally downwards from shoulders.

Erector Spinæ, &c.

Fig. 21. Movement.

Raise the body to an erect position and carry the head and shoulders as far back as possible by bending the back. At the same time raise the arms as far as possible straight above the head. Return to original position and repeat.
Keep the knees and elbows stiff throughout the movement.

Exercise 12. (B♮).

Fig. 22. · Position.

Back to Exerciser (handles at bottom).
Heels about six inches apart and level, feet at an angle of 90°.
Cords between legs.
Handles in each hand, palms downwards.
Body bent forward, knees straight.
Arms fully extended downwards, horizontally from shoulders, and back between legs as far as possible.

Erector Spinæ, &c.

Fig. 23. Movement.

Raise the body to an erect position, and at the same time keep the arms horizontal to the shoulders.
Return to original position and repeat.
Keep elbows and knees stiff throughout the movement, and concentrate the work upon the back muscles.

Exercise 13. (F).

Fig. 24. Position

Face to Exerciser.
Advance one foot and bend the knee.
Handles in each hand, palms upward.
Keep the elbows close to the sides.
Bend the elbows.

Triceps, &c.

Fig. 25. Movement.

Fully straighten the arm without moving the elbows forwards or backwards. Carry the hands past the hips.
Return to original position and repeat.

Exercise 14. (B1). Deepening the Chest.

Fig. 26.

Position. Back to Exerciser.
Advance one leg and bend the knee. Handle in each hand, palms forward. Arms fully extended downwards and backwards so that hands are about a foot behind the hips.

Movement. Circle the hands forwards and upwards till they are nearly level with the shoulders. Return to original position and repeat. Thrust the chest well forward and inhale as the arms go backwards. Keep elbows stiff throughout the movement.

Exercise 15. (B). Sterno-Mastoid, &c.

Fig. 27.

Position. Back to Exerciser.
Advance one leg and bend the knee. Both handles in right hand, palm forwards. Grasp back of right wrist with left hand. Place back of left wrist upon the forehead.

Movement. Bend the neck forwards and backwards, letting the head go as far forwards and backwards as possible without bending the body. Do not pull with the arms.

Exercise 16. (S).

Fig. 28. Position.

Left side to Exerciser.
Advance the right leg and bend the knee.
Both handles in right hand, palm downwards.
Elbow bent and wrist placed on side of head.

Sterno-Mastoid, &c.

Fig. 29. Movement.

Move the head from side to side.
Keep the body steady and arms still.
Use the left side in turn.

Exercise 17. (B+).

Fig. 30. Position.

Back to Exerciser.
Advance one leg and bend the knee.
Handle in each hand, cords over shoulder, and hands clasped behind back.
Body bent back as far as possible.

Rectus Abdominis, &c.

Fig. 31. Movement.

Bend the body forwards and downwards as far as possible without bending the knees.
Return to original position and repeat.

Exercise 18. (B†).

Fig. 32. Position.

Back to Exerciser.
Heels about six inches apart and level, feet at an angle of 90°
Knees straight.
Handle in each hand, palms forwards.
Arms fully extended straight above head as high as possible.
Body bent back as far as possible.

Rectus Abdominis, &c.

Fig. 33. Movement.

Bend the body forwards and downwards, at the same time circle the hands horizontally forwards and downwards until they nearly touch the ground.
Return to original position and repeat.
Keep elbows and knees stiff throughout the movement.

Exercise 19. (S†).

Fig. 34. Position.

Left side to Exerciser.
Advance right leg and bend the knee.
Both handles in right hand.
Bend the elbow and place wrist on side of head.

Obliquus Abdominis, &c.

Fig. 35. Movement.

Bend the body sideways over the right hip, and well bend the knee
Return to original position and repeat.
Use left side in turn.

Exercise 20. (B†).

Fig. 36. Position.

Back to Exerciser.
Heels close together.
Both handles in left hand—palm forwards.
Left arm extended above head as far back as possible.

Obliquus Abdominis, &c.

Fig. 37. Movement.

Circle the hand forwards and downwards across the body (which is at the same time bent forwards) to a point as close to the right toe as is possible.
Return to original position and repeat.
Keep the elbow and knee stiff throughout the movement.
Use the right arm in turn.

Exercise 21. (Ft). Rectus Abdominis.

Fig. 38.

Position. Recumbent.—Feet to Exerciser (handles at bottom), arms extended over head and grasping something. Feet attached to handles.

Movement. Circle the feet upwards and forwards till they are vertical and opposite the hips. Return slowly to original position and repeat. Keep the knees and ankles stiff throughout the movement.

Exercise 22. (H†).

Fig. 39. Position.

Recumbent.—Head towards Exerciser (handles at bottom).
Arms fully extended straight above head.
Handle in each hand, palms upwards.

Exercise 22. (Continued).

Fig. 40. 1st Movement.

Circle arms upwards and forwards in front of body and raise the shoulders about four inches from the floor, keeping elbows stiff.
Return to original position and repeat,
Or proceed to the second part of the movement.

Rectus Abdominis, &c.

Fig. 41. 2nd Movement.

Bend the arms till the hands nearly touch the back of the head, then sit upright.
Return slowly to the original position (Fig. 28) and repeat. There should be no break between the two movements. At first it is better to leave out the second part of the movement until the abdominal muscles have become strong.

Exercise 23 (H†). Obliquus Abdominis, &c.

Fig. 42.

Position. Recumbent.—Head to Exerciser (handles at bottom). Both handles in left hand, palm upwards. Arm fully extended straight above head.

Movement. Circle the arm upwards, forwards and across body, as it is raised sideways, till the left hand is carried over the right hip. Return to original position and repeat. Keep elbow stiff throughout the movement.

Exercise 24. (B). Flexors in Forearm.

Fig. 43.

Position. Back to Exerciser.
Advance one foot and bend the knee Handles in each hand, palms forwards. Elbows bent and on a level with shoulders.

Movement. Bend the wrists backwards and forwards as far as possible without moving the elbows from their position.

Exercise 25. (F). Extensors in Forearm.

Fig. 44.

Position. Face to Exerciser (handles at bottom). Advance one foot and bend the knee. Handles in each hand, palms downwards. Arms fully extended downwards in front of hips. Elbows nearly touching sides.

Movement. Circle the hands upwards, and at the same time carry them inwards till they nearly touch the shoulders. Return to original position and repeat. Do not move the elbows forwards and backwards. If this movement is performed properly there is scarcely any action of the biceps, which is a supinator as well as a flexor

Exercise 26. (F). Biceps, &c.

Fig. 45.

Position. Face to Exerciser (handles at bottom). Advance one foot and bend the knee. Handles in each hand, palms upwards. Arms fully extended downwards in front of hips. Elbows nearly touching sides.

Movement. Circle the hands upwards till they nearly touch the shoulders, by bending the elbows. Return to original position and repeat. Do not move elbows forwards and backwards, and be careful to fully extend and fully flex the elbows so as to get full action of muscles.

Exercise 27. (S).

Fig. 46. Position.

Left side to Exerciser (handles at bottom).
Advance the right leg and bend the knee.
Both handles in the left hand, palm upwards
Left arm fully extended outwards.

Biceps, &c.

Fig. 47. Movement

Curl the hand upwards and inwards till it nearly touches the side of the ear.
Return to original position and repeat.
Use the right arm in turn.

Exercise 28. (F).

Fig. 48. Position.

Face to Exerciser (handles at bottom).
Advance the left leg and bend the knee.
Both handles in the right hand, palm backwards.
Right arm fully extended downwards so that the hand is opposite the hip in front.

Posterior Deltoid, &c.

Fig. 49. Movement.

Circle the hand backwards and upwards as far as possible.
Return to original position and repeat.
Keep the elbow stiff and the body still throughout the movement.
Use the left arm in turn.

Exercise 29. (S).

Fig. 50. Position.

Left side to the Exerciser (handles at bottom).
Advance the right leg and bend the knee.
Both handles in the right hand, palm downward.
Right arm fully extended downwards so that the hand is opposite the hip.

Lateral Deltoid, &c.

Fig. 51. Movement.

Circle the hand directly outwards and upwards till it is in a horizontal line with the shoulder.
Return to original position and repeat.
Keep the elbow stiff throughout the movement, and the body perfectly still.
Use the left arm in turn.
It is of great importance to stand upright, and to prevent the body from swinging round in this exercise.

Exercise 30. (F†). Anterior Deltoid, &c.

Fig. 52.

Position. Face to the Exerciser (handles at bottom). Advance one leg and bend the knee. Handle in each hand, palms downwards. Arms fully extended downwards in front of hips.

Movement. Raise both arms straight up above the head. Return to original position and repeat. Keep the elbows stiff and the body still throughout the movement. Inhale deeply as the arms are raised. Movement good for expanding the chest and lungs. This action can be made much stronger by keeping the palms upward.

Exercise 31. (B1). Quadriceps Extensor, &c.

Fig. 53.

Position. Back to the Exerciser (handles at bottom). Feet about six inches apart. Handles in the hands, clasped above the head. Knees and thighs bent. Body inclined forward,

Movement. Raise the body to an erect position, stand on tiptoe, and push the arms up overhead as high as possible. Return to original position and repeat.

Exercise 32. (S).

Fig. 54. Position.

Left side to the Exerciser.
Left foot attached to both handles.
Left leg fully extended horizontally outwards from hip.
Keep the balance by holding on to a chair.
Body bent sideways over right leg.

Adductors of Leg. (Adductors Brevis, Longus and Magnus, &c.)

Fig. 55. Movement.

Circle the left foot downwards and inwards to the floor without bending the knee.
Return to original position and repeat.
Use the right leg in turn.

Exercise 33. (S).

Fig. 56. Position.

Left side to Exerciser (handles at bottom).
Left foot attached to both handles.
Left leg fully extended downwards and outwards.
Keep the balance by holding on to a chair.

Sartorius, &c.

Fig. 57. Movement.

Carry the left leg inwards across the right leg as far as possible without bending the knee.
Keep the right leg and body still.
Return to original position and repeat.
Use the right leg in turn.

Exercise 34. (S). Abductors of Leg (Gluteus Medius, &c.)

Fig. 58.

Position. Left side to the Exerciser (handles at bottom). Right foot attached to both handles. Right leg fully extended downwards. Keep the balance by holding on to a chair.

Movement. Circle the right foot outwards and upwards as high as possible without bending the knee. Keep the left leg and body still. Return to original position and repeat. Use the left leg in turn.

Exercise 35. (B). Ilio-Psoas, &c.

Fig. 59.

Position. Back to the Exerciser (handles at bottom). Left foot attached to both handles. Left leg fully extended downwards and slightly forwards. Keep the balance by holding on to a chair.

Movement. Circle the foot forwards and upwards as high as possible without bending the knee. Keep right leg and body still. Return to original position and repeat. Use the right leg in turn.

Exercise 36. (F). Hamstring Muscles (Biceps, &c.).

Fig. 60.

Position. Face to Exerciser (handles at bottom). Right foot attached to both handles. Right leg fully extended downwards. Keep the balance by holding on to a chair. Bend the body slightly forward.

Movement. Bend the knee by carrying the foot backwards and upwards. Return to original position and repeat. Use the left leg in turn.

THE WHITELY HEALTH EXERCISER CHART

FOR

LIGHT DUMB-BELL DRILL.

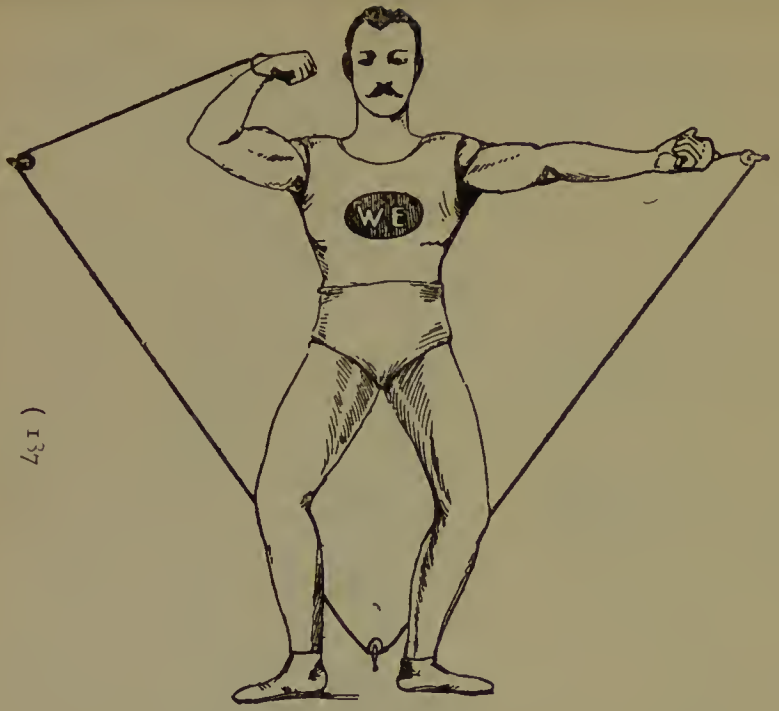
For those who still believe in the old exercises that have been devised for the use of dumb-bells, we have arranged a Chart showing how these same exercises may be used with the Whitely Health Exerciser by the addition of one or two extra screw hooks. We, however, venture to think that the same groups of muscles can be much more efficiently exercised by following out the instructions contained in the Anatomical Chart, and we feel sure that our readers will speedily come to the same conclusion after they have made a good trial of both systems.

1.—Pectoral, Deltoid, Triceps, Serratus Magnus (Striking Muscles).

A: Lunge forward with right foot, at the same time

2.—Triceps.

Bend the arms up till the backs of hands nearly touch the shoulders; alternately straighten each arm to its fullest extent downwards.

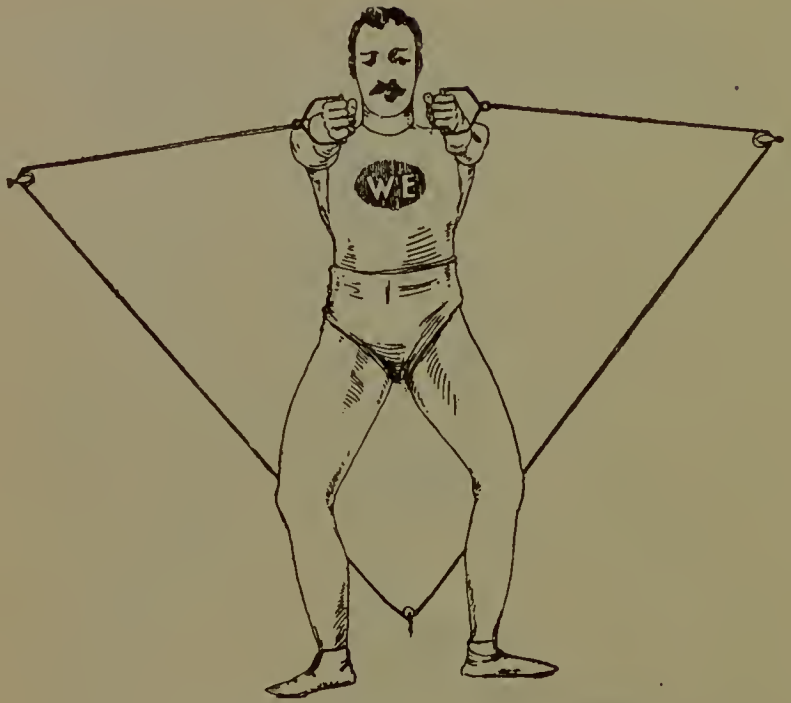


3.—Biceps.

Fully extend the arms outwards on a level with the shoulders with the palms upwards; alternately bend each arm till the hand nearly touches the shoulder.

4.—Biceps.

Same as No. 3, using both arms at the same time.

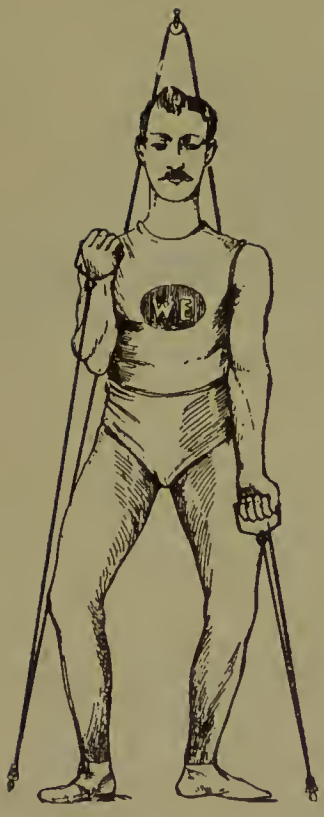


5.—Pectoral and Anterior Deltoid.

Fully extend the arms horizontally forwards on a level with the shoulders, throw them back in a line with the shoulders, and return. Keep elbow stiff throughout the movement.

6.—Flexors in Forearm.

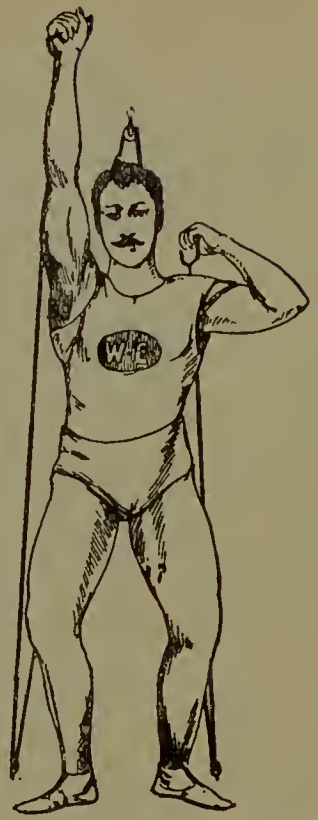
Fully extend the arms outwards on a level with the shoulders, and bend the wrist upwards and downwards.



7.—(a) Biceps.
(b) Extensors in Forearm.

A: Fully extend the arms downwards with palms to the front, alternately bend each arm upwards till the hand nearly touches the shoulders, and return; keep the shoulders squared and the elbows close to the sides throughout the movement.

B: Fully extend the arms downwards, with the palms pointing downwards, and the back of the arm to the front, alternately bend up each arm till the knuckles nearly touch the shoulder, and return.

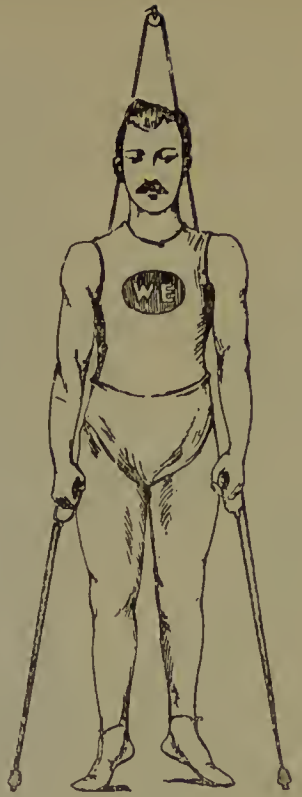


8.—Triceps, Deltoid, Trapezius.

Bend both arms upwards with palms inwards, and alternately raise each arm up to a vertical, and return.

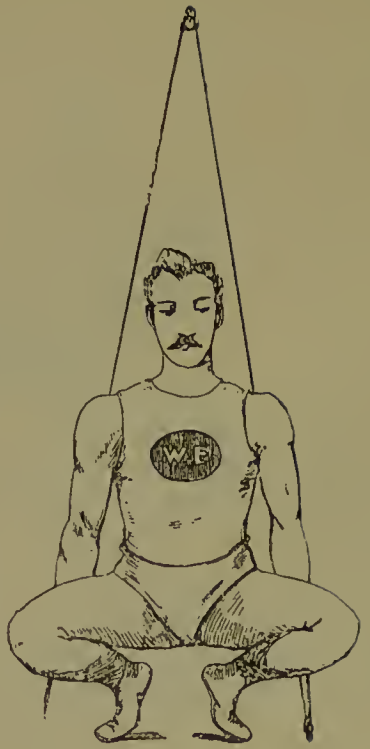
9.—Anterior Deltoid, Trapezius.

Fully extend the arms downwards, with the palms downwards, and alternately raise arms to the full extent forwards and upwards, and return.



10.—Gastronemius Soleus.

Raise the body on the toes and return to the ground on the heels.



11.—Muscles of the Thigh and Calf.

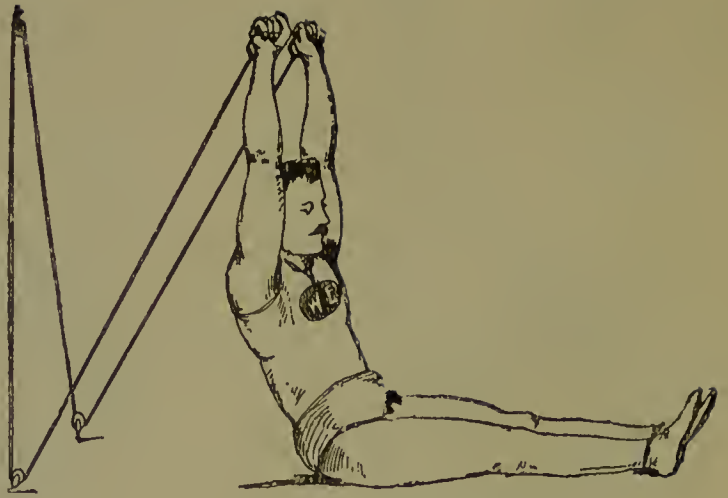
Raise the body on the toes, then gradually lower the body by bending the knees and the thighs; keep the legs at an angle of 90 degrees, and return to the erect position.

12.—Obliquus Abdominis.

Bend the trunk sideways on the hip joint alternately to the right and left. Action : Good for balancing Muscles of the Trunk, the Obliquus Abdominis, and other Muscles that support and protect the sides of the Abdomen. At the same time alternately bend each arm and wrist until the hand reaches the arm-pit.

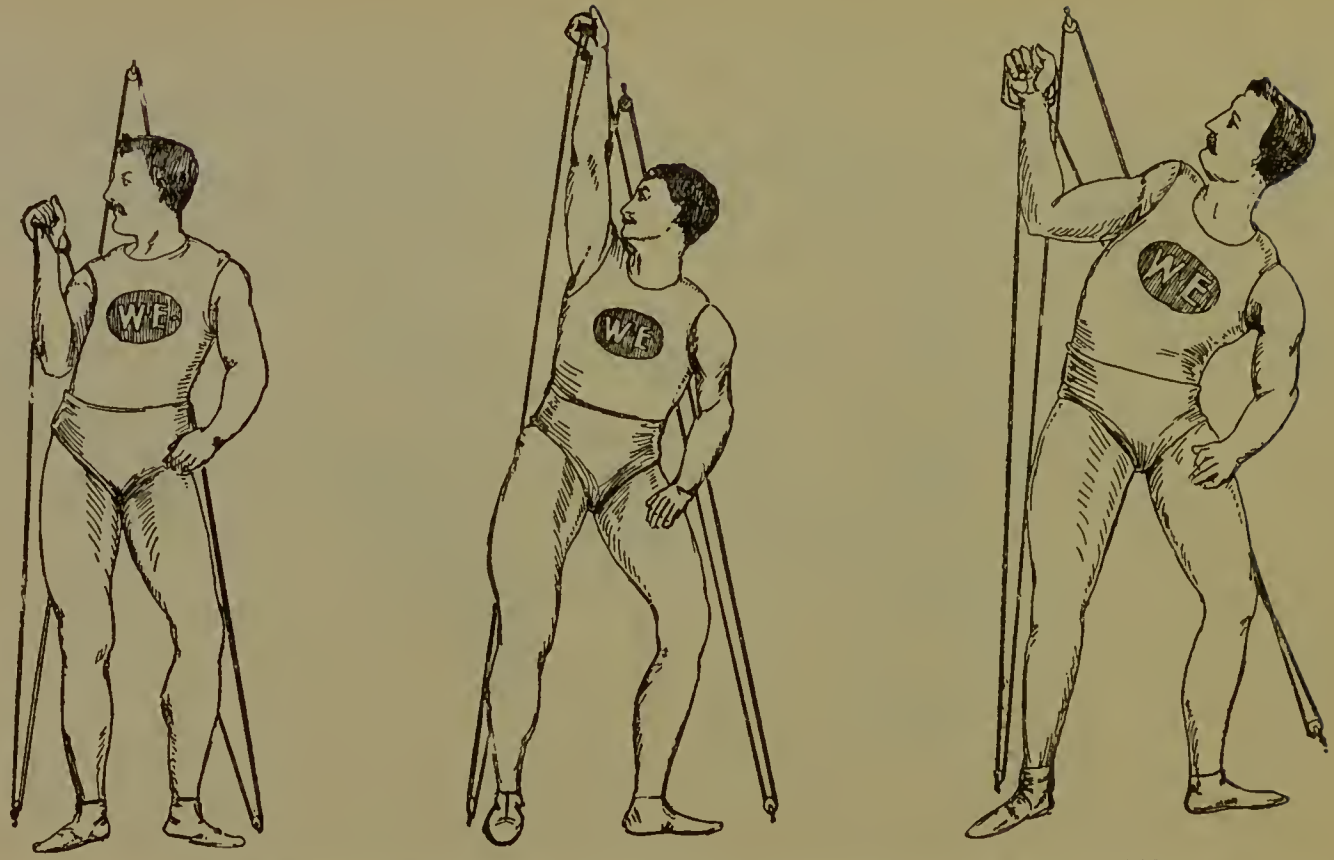
13.—Triceps, Trapezius, &c.

Take the prone position, supporting the weight of the body upon the hands and toes, lower the body by bending the elbows, and raise it again by straightening the arms. The body and knees must be kept perfectly straight throughout the movement, and no part of the body or legs must touch the floor.



14.—Abdominal Muscles.

Lie flat upon the back, with the arms fully extended upwards at the side of the head, raise the body to a sitting position, and return. At first, place the feet under a sofa, and practise without the Exerciser.



15, 16, & 17.—MOVEMENTS USED IN LIFTING HEAVY WEIGHTS.

One hand slow press from shoulder. As the arm is pressed upwards, the body should curl downwards, and to the right until it gets underneath the weight; much assistance is rendered by the arm and hand not engaged.

18.—ADDUCTOR, MAGNUS, LONGUS AND BREVIS, PECTINEUS, SARTORIUS (Adductors of Leg).

Sit on a stool with the Exerciser attached to each leg just below the bent knee, feet together, thighs extended outwards at an angle of 90 degrees. Bring the knees together without moving the feet, and return—a good exercise for curing bow legs.

19.—Gluteus, Medius, and Minimus (Abductors of Leg).

Sit on a stool with the Exerciser attached to each leg just above the bent knee, the left cord to the right leg, and the right cord to the left leg. Separate the knees as far as possible without moving the feet, and return—a good exercise for knock-knees.

20.—Quadriceps Extensor.

Sit on a stool and attach the Exerciser to each foot with the legs fully extended downwards. Bend the knees till they nearly touch the chest, and then fully straighten the legs.

CONTENTS OF PART III.

Part III.

MUSCULAR EXERCISE

AND ITS RELATION TO HEALTH AND STRENGTH.

The nutriment extracted from the food is taken up by the blood, which, as it circulates about us, deposits where needed the proper amount and kind of material for repairing each particular part of the body, and in turn gathers up the worn-out and impure matter, and conveys it to the proper organs for elimination. If it is not circulated regularly and freely, impure and effete matters accumulate, causing irritation and subsequent disease, for the tissues of the body are constantly breaking down, and as constantly being repaired, and the double function of supplying the nutriment and removing the waste is effected by the circulation of the blood.

What has muscular action to do with the circulation of the blood? Much; for the force of the heart's action, after sending the blood through the arteries, out into the muscles and other parts of the body, is pretty well spent, and some other force is

necessary to bring it promptly back again through the veins. This necessary additional force is furnished by the muscles, which, when contracting or hardening, press upon the veins, and force the blood onward towards the heart—always onward, for the veins are supplied with valves like those of a pump, which admit the blood, but will not permit its return in the same direction whence it came.* Muscular activity also accelerates the circulation by drawing the blood to the muscles that are working, and thus relieves congestion of the internal organs.

Upon the muscles, this alternate relaxation and contraction while in action has the effect of charging and re-charging them with fresh blood, and muscle-making material, causing them to rapidly increase in size and strength, hence the necessity of a good blood supply to ensure a healthy muscular development. Moreover, the brain not being a muscular organ, must rely upon bodily activity to draw down the blood that has been used, and make room for new; for unless the supply of blood to the brain is frequently changed in this way, the organ loses its capacity for vigorous thought, and congestion, headache, insomnia, insanity, etc., are in order. The nervous system (including the brain, the spinal cord, and the nerves) being involved in every muscular action, is kept in good tone by

* See Dalton's Physiology, pp. 296, 297; Flint's Text Book of Human Physiology, pp. 101, 102; Kirk's Hand Book of Physiology, pp. 156, 157.

proper exercise, and is damaged by inactivity or over-exertion, hence the nervous disorders that are so frequently the outcome of over or under activity. Respiration, whose function it is to supply oxygen to the blood, and to excrete its carbonic acid gas, is stimulated by exercise, because muscles, when in action, require more ogxyen for their nourishment and give off more carbonic acid gas.

With these facts before us, it is plain that a certain amount of muscular activity is absolutely necessary to retain good health ; and that systematic and persistent exercise must go far toward insuring immunity from the many ills that flesh is heir to.

But in order to keep up a healthy circulation, it is not necessary to *strain* the muscles, as is done in heavy gymnastics, which, however good as tests of strength, are by no means the proper thing to develop it. Nor is it necessary to suffer fatigue by over-exertion, as is frequently done by athletes in attempting feats beyond their strength, and by cyclists in riding too far or too fast. For such severe labour brings about a hard slow-acting development that is not desirable : a condition known to athletes as " muscle bound," which means an hypertrophy of the muscles. In Dr. Coat's Manual of Pathology we find " The simplest form of hypertrophy is that which arises from the necessity for the excessive performance of a normal function. . . . We know that the voluntary muscles hypertrophy when they are repeatedly exercised in a

forcible way. The muscular tissue of the heart also undergoes an exactly similar hypertrophy when, in order to expel the blood from its cavities, more forcible contractions are requisite. . . . The work to be done must require an unusually forcible exertion. . . . The heart does not hypertrophy, because its muscle undergoes frequent exercise, but only when additional force is required. It is so also in the case of voluntary muscles. Mere agility and rapidity of movement does not cause hypertrophy of muscle, whereas repeated severe exertion calls it forth." Other pathologists describe two kinds of hypertrophy, the true hypertrophy and the false or pseudo-hypertrophy. Dr. Green writes: "The terms false or pseudo-hypertrophy indicate that the enlargement of an organ or part is due to over-growth of one set of elements, often at the expense of another. It is the connective tissue which generally becomes excessive, whilst the higher tissues atrophy—e.g., pseudo-hypertrophy of muscle. In these cases functional power is diminished." From this we learn that the true physiological hypertrophy, or the healthy increase in the size of the muscular tissue, is brought about by the frequent exercise of the muscles with only a light resistance, and that the false pathological hypertropy, or the unhealthy increase of the connective in the place of the muscular tissue, is the result of constantly straining the muscles by the use of heavy weights.

Exercise, with moderate tension, brings a copious supply of blood to the muscles and a development of pure muscular fibres, which is in itself a sufficient reason for the great care that should always be taken in the selection of the particular kind of exercise, for if by over exertion or by strain you develop an hypertrophied muscle, you will also develop an hypertrophied heart, and will strain your internal organs, and this is the cause of the rapid degeneration, ending in death at an early age, of our most prominent athletes.

The exercises necessary for the development of the muscular system also bring into action and develop the internal organs (which rely, to a great extent, upon the tone of their muscular tissue for their efficient working) and other structures; hence the cure of certain digestive troubles under systematic and intelligently directed exercise.

Long ago Mr. Alexander Shaw pointed out (*Medical Times and Gazette*, July and September, 1842), how the movements of the diaphragm facilitate the flow of blood through the liver, brought to it by the valveless portal vein. A deep inspiration sucks the blood into the liver, while expiration expels it with a jet. Exercise is thus indicated in the cases of liver affections.

There is but one condition that endangers the wild animal, and that is confinement—inactivity. In their wild state instinct gives them such proper habits that they grow to full stature, and throughout life possess a

store of vitality that makes them superior to disease.

It is just as possible for humanity to so live as to become invulnerable to disease, or, having contracted it, to fight it off. The recuperative force in man is as strong as in the animals; and, if properly directed, will repair almost any injury or cure any disease.

There is no royal road to physical salvation. Nature is exacting, and the physical sins of a lifetime may not be atoned for in a few hours. But our experience, and that of hundreds of others—among them a man whose parents both died of consumption, and whose symptoms indicated that he was doomed to speedily follow, but who has since become a model of physical prowess and mental vigour combined—prove that people must be ill indeed who can not be made well by persistence in living in a *natural*, even though civilized manner.

A scientific system of muscular exercise is a good remedy for all functional disorders and many diseases of the vital organs, it stimulates the heart, lungs, and digestive organs, it removes all the waste products from the body, and so purifies the blood, the whole of the tissues of the body are properly nourished, and disease gradually gives way to health. The flabby heart becomes strong, the contracted chest becomes expanded, sluggish digestion disappears, and with it the various nervous ailments that are always in attendance, the hypochondriac finds enjoyment in life, the hysterical girl becomes a

pleasant companion, and the man with the liver good-tempered.

Suitable exercise is the only good antidote to the artificiality of the mode of living at the present time. It is the high speed at which the brain works in a body that is poorly developed from want of exercise that condemns thousands to invalidism, a premature old age, and early death. Whereas fifteen minutes a day spent in cleansing the internal economy by getting rid of its waste products would restore health to many who have lost it, and prevent those who are compelled to lead sedentary lives from losing that most precious gift.

If only the public could realise half the value of systematic exercise, there would be no place of habitation, home, office, or school without the Whitely Health Exerciser. No club, pavilion, gymnasium, or boat-house is complete without it, as it plays such an important part in all forms of training carried out on scientific lines.

SLEEP AND RECUPERATION.

THE moment the current is turned on to an electric light, consumption of the carbon commences, and after a number of hours, an interval must elapse to permit repair, or renewal of the carbon, during which time the current is shut off.

The moment Life manifests itself in

muscular or other action, breaking down, or consumption of tissue commences, to repair which, after a period of long or short duration, depending upon the condition and vitality of the person, an interval of time must elapse; hence we sleep. During rest, the material deposited by the blood during the day is made into tissue, ready for the next day's demand. Under an emergency, people can go a long time without sleep, and still keep up vigorous action, particularly muscular action; as witness the terrible six-day matches, in which the participants sleep not at all, or but an hour or two daily. Brain work will not admit of such lengths; though our legislators sometimes retain their seats for many hours without closing their eyes. But such tasks are a terrific drain upon our vitality, and must be equalized sooner or later, or result in permanent injury.

Retiring too late, or rising too early, does not permit sufficient time for repair.

The suggestions in the preceding chapters, modified to suit the condition and constitution of the individual, will help each to keep themselves proof against disease; or, having, through ignorance or folly, permitted it to overtake them, will aid them in fighting it off.

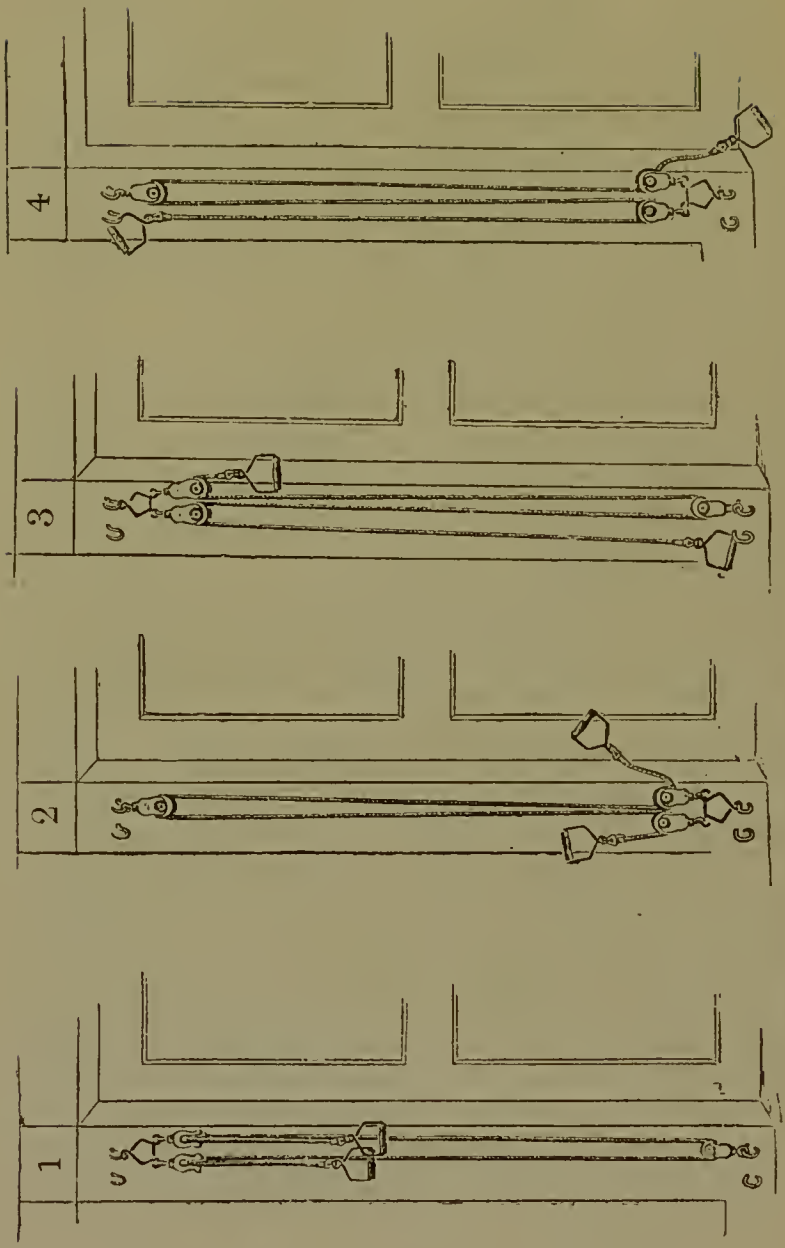
The WHITELY HEALTH EXERCISER

It has been demonstrated that heavy gymnastics, like numerous other ponderous and

unwieldly things of the past, are by no means the best. On the contrary, exercise that admits of numerous vigorous movements of the muscles, WITHOUT GREAT FATIGUE, produce larger development and better quality. Muscular tissue built in this way is not only strong, but quick, active, and lasting, while that developed with heavy weights is hard, slow, and short-lived.

You are not required to waste time in the preliminary study of an intricate system of movements. For brain workers, a system that requiries study is directly at variance with one of the prime objects of muscular exercise—namely, entire relief from mental strain. But, if you do not have to think, it is because some one has done it for you ; for the exercises, howbeit simple, are scientifically arranged to bring into action every muscle of the body. Dumb-bells and Indian clubs exercise the muscles of the arms and shoulders, but do not reach the muscles that pull the arms downward. The result of this uneven development often causes a swagger that is far from graceful.

With this method you gain health and strength by a system of scientific and exhilarating exercises, which bring about rapid development without taxing your time or energy ; and there is no fear of hypertrophy of the heart, so liable to undergo degeneration after middle life.



DIFFERENT POSITIONS IN WHICH THE EXERCISER IS USED.

DIRECTIONS FOR PUTTING UP THE EXERCISER.

THE Exerciser will work at any angle, so select any place in your room that permits an unobstructed floor space in any direction. Better work toward a window that will permit of ventilation from above than away from it.

Screw a hook into the door or window frame at a height to which you can conveniently reach, and a lower hook into the floor.

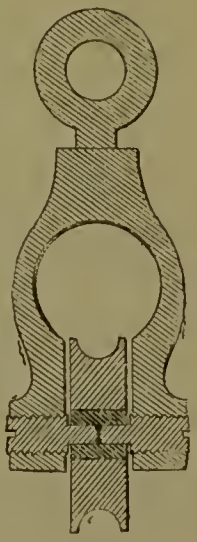
Should there be a sill or other obstruction to be avoided, put the lower hook in the floor at sufficient distance from the wall to make the cords clear the obstruction.

The middle pulley is purposely made without a swivel, to prevent twisting of the cord when in use, so run out any twist between it and the pulleys attached to the triangle before putting it on the hook.

The pulleys on the triangle are swivelled that the Exerciser may adjust itself to any movement, or work in any direction, and if the cords twist together between them and the handles, a pull on the latter will untwist them.

Frequently put a very little oil on the swivel and in the slots of the screws on the pulleys, and wipe off any surplus that might get on the cords, for oil destroys the tensile properties of

rubber. If the pulleys rattle when not in need of oil, a slight tightening of the screws will stop it.



The sectional cut as illustrated will show you how the pulleys are made. The adjustable bearings make them expensive, but they also make them noiseless—quite an important feature for a home exerciser.

The rubber cord, or rather cable, is calculated to withstand unlimited use and much greater tension than required for ordinary exercise, but do not on that account abuse it.

The Exerciser is made in different strengths for the use of children, women, men and athletes respectively, and the resistance of each can be increased by taking up a position at a distance from the attachment, which should not exceed six feet at the outside, otherwise an undue strain is imposed upon the rubber cable and the pulleys.

The resistance of the women's machine is seven pounds in each hand, at a distance of six feet from the Exerciser, and this diminishes to one and a half pounds in each hand at the nearest point; at the same distances, the men's varies from thirteen to six pounds in each hand, and the athletes' from twenty pounds to eight pounds. If both handles are taken in one hand, the resistance is doubled, so that each machine gives a variety of

resistances according to the way in which it is used, and as each exercise is performed, the resistance gradually increases until the maximum contraction is obtained, which ensures a perfect development of the whole of the body of the muscle.

DON'T USE A CORD THAT IS TOO STRONG FOR YOU.

If you do, you will be exhausted, but not benefited by your exercise. The cords are made of various strengths; be sure you obtain one adapted to you—that is, one that pulls easily when close to the Exerciser. As you grow stronger, you have only to stand a little further from the Exerciser to obtain a resistance suited to your increasing strength. Read the book! it may make all the difference of success or failure in obtaining benefit from your exercise. Roughly speaking, the resistance should be one-twentieth of the weight of the body, which would give a resistance of four pounds in each hand for a 12-stone man. Without any resistance, there is not a full demand for muscular contraction.

HOW TO USE THE EXERCISER.

USE no more force than is agreeable. You have only to step forward or backward to regulate the tension.

If your exercise is too vigorous, or too heavy, you will be exhausted before you com-

plete it. It is better to exercise all parts of the body a little than a few much. If you are sick or weak, exercise very moderately, and stop the moment you feel the least exhausted. If well and strong, be moderate for the first week or two, or the exercise will make you stiff. When a muscle is tired, it hurts, and to force it beyond that point is harmful.

Exercise when you have time for it. Not for two hours after meals, certainly, unless it be very moderately. After eating, the digestive organs need the blood, which by exercise would be drawn to the muscles.

Sedentary people should keep the apparatus in the office, if possible, to exercise when they feel the need of it; that is, when the brain is tired and the thoughts refuse to flow freely. A little vigorous exertion will renew the supply of blood in the brain, and with new blood will come clear thought and new ideas.

A tired feeling is not always due to exhaustion! it is more frequently due to congestion of the blood in some particular spot, and is quickly dispelled by exercise. Make the attempt, but if the tired feeling does not soon disappear, you will understand that it is true exhaustion, for which sleep is the only remedy.

Make up your mind that you will exercise, be it midnight or morning, when you retire, and you will be repaid for it in the quality of sleep that follows; though at such times,

unless excited, it is well to somewhat curtail the amount of each movement, or you will tire before you finish the list. At such times, also, some regard to the muscles that have been used through the day is advisable; but when you have time to exercise each group of muscles completely, this matter will regulate itself, for those that have been used during the day will tire sooner than the others.

Nature puts a limit to muscular development, beyond which no amount of exercise will force it, and it is, therefore, only necessary to exercise all the muscles regularly, to eventually bring the entire body to a symmetrical shape, and the highest stage of development. It takes from two to three years to develop to a maximum.

If practicable, take your exercise in the condition indicated in the cuts; for at least once a day the body should be free to act without the restraint of clothing, and, moreover, fresh air is a tonic to the skin, which lessens the chances of taking cold.

Fresh air is an indispensable adjunct to exercise, but the room should never be chilly.

Never exercise beyond the ability of the heart to keep pace with you; palpitation is a sure indication of excess. Exercise only as vigorously as is in keeping with your strength.

Do not exercise too long or too hard early in the morning, as it is apt to exhaust you, and you do not recover during the day. If you rise as late as half-past eight or nine,

vigorous exercise is not likely to hurt you, unless you bolt your breakfast and rush off to work immediately following it. In making the movements, endeavour to forget you are exercising by concentrating your attention upon the muscle which effects the movement.

We recommend the following daily routine:—Erect the machine in the bed-room or bath-room.

On rising, freely ventilate the room, and then, in Nature's garb, carefully exercise all the muscles of the body, giving to each its due proportion of movements, which must be regulated according to the time at your disposal. They can all be well exercised in 15 minutes if you go methodically to work, and do not waste any time between each exercise. If you cannot spare so much time, use a fewer number of movements to each exercise. If there is an inclination to any deformity, such as a drooping or round shoulder, pay great attention to the muscles that allow of the deformity.

Study your muscular system, and both your work and interest in it will improve.

Repeat the same dose at night, just before getting into bed, but do not spend more than 30 minutes daily.

If you prefer it, you may divide the system of exercises into two parts, and devote, say, 10 minutes to the first half on rising, and 10 minutes to the second half on retiring.

After the morning exercise, put on a dressing gown, and rest until the perspiration has

ceased. Then take your morning bath, which should be a cold one if you can stand it. Unless you feel warm directly you leave the water, you may know that the cold bath does not agree with you. If such be the case, add a sufficiency of warm water to take the chill off. There is great danger of getting a "chill" if you plunge into a cold bath when you are perspiring freely, for the blood vessels of the skin are dilated and full of blood, and the cold chills the blood; the vessels in the skin at once contract, and the chilled blood is sent straight to the internal organs.

The bath may be taken in another form; the bather, standing in a few inches of water, either cold or tepid, according to his requirements, rubs himself vigorously with wetted flesh gloves; by this means the shock of the sudden plunge into a bath, which is not good for some constitutions, is avoided.

After the bath, the body should be thoroughly rubbed down with a roughish towel, until the skin is all aglow; this gives a beautiful tone to the skin, dispels fatigue, exhilarates the nerves, and the whole being feels full of energy.

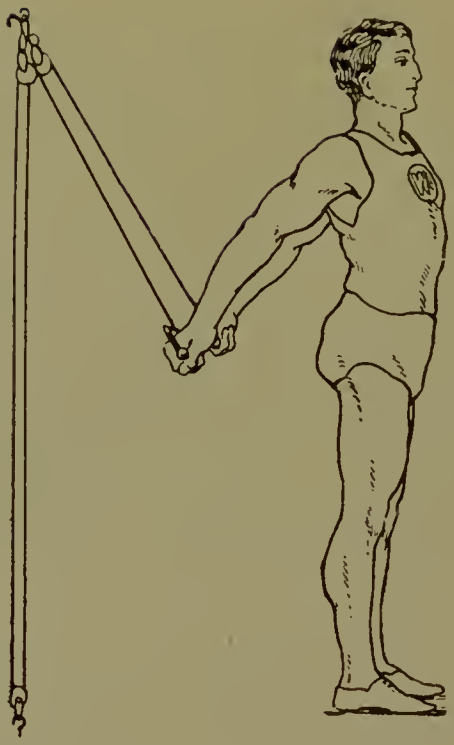
THE WHITELY HEALTH EXERCISER CHART.

While practising with back to the Exerciser, in all movements excepting those particularly specified on the chart, advance either foot, as the operator may choose, and bend the leg forward as is done in boxing or fencing. Keep the body erect, the chest well out, and the abdomen drawn in, and make the movements without swaying the body, so as to concentrate the work on the particular group of muscles brought into play. A reference to the special chart will explain clearly those exercises which should be done by using the body. While facing the Exerciser, adopt the same position as above for the movements intended to be made with the arms, wrists, shoulders, etc. Continue the exercise without varying the position of the body until the work becomes hard, at the rate of from 30 to 60 movements a minute.

The exercises will be fully described, and, we hope, will prove of great value to our patrons, and will enable them to perform the movements correctly; but our experience is that as so much depends upon the position and the manner of exercising, very few people attain the best results without having first undergone a course of instruction in the system of the localisation of muscular move-

ments. There are many ways of doing the exercises, but only *one* right one, and whereas good results will follow in most cases, yet the best results can only be obtained by learning the scientific use of the Exerciser, and we are certain that, if the health does not improve, it is the fault of the user and not of the used.

Many, through their work at the desk or elsewhere, become slightly deformed. Their round and drooping shoulders cramp their chests, and form the foundation, so to speak, of future ailments. By special exercises they can be restored to their normal figure, but if left alone, will gradually get worse, and perhaps eventually become incurable.

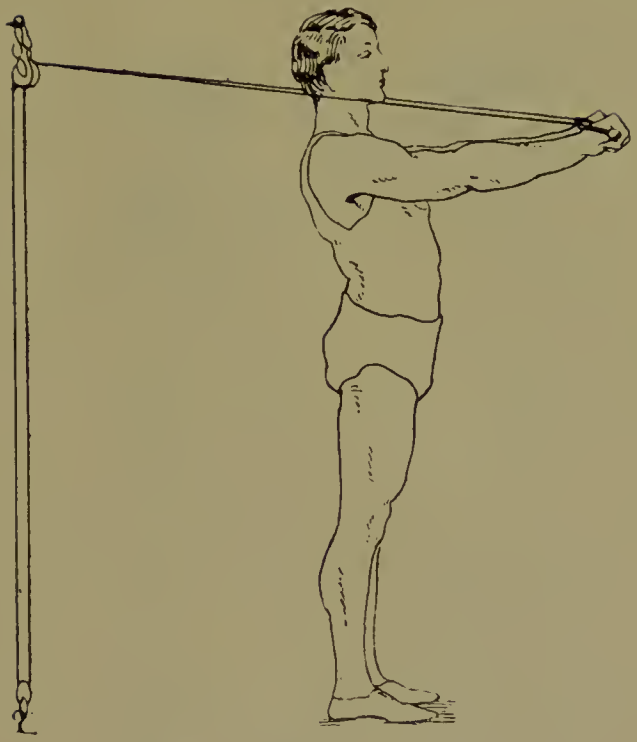


1.—Broadening the Chest.

Bring arms in front of body, keeping elbows stiff. Inhale, and thrust chest forward on return.

Position. Back to the Exerciser.
Advance either foot and bend the knee.
Handle in each hand, palms downwards.
Arms fully extended downwards to a point about a foot behind the thighs.
Hands close together.

Movement. Carry hands straight forwards to a point about a foot in front of the thighs, keeping the arms fully extended.
Return to original position.
Inhale deeply and thrust chest well forward as the hands are carried backwards.
Keep elbows stiff throughout the movement.

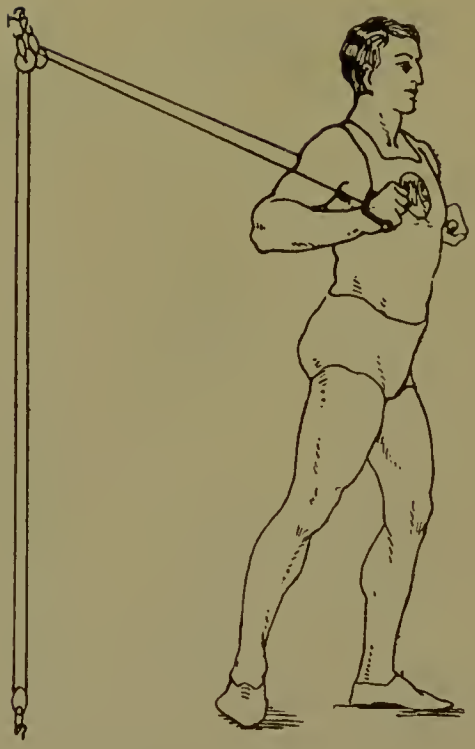


2. Deepening the Chest.

Raise arms from the horizontal to the perpendicular, and return, keeping the elbows stiff. Inhale as the arms are raised.

Position. Back to the Exerciser.
Advance either foot and bend the knee.
Handle in each hand, palms downwards.
Arms fully extended to the front on a level with the shoulders.
Hands close together.

Movement. Circle the arms upwards and backwards to a point directly above the head, reaching as high as possible.
Feel that the chest is raised when the hands are at the highest point by the muscles that pass from the arms to the ribs. The muscles of the abdomen will also be put on the stretch.
Return to original position.
Be careful to keep the elbows stiff throughout the whole movement.
Inhale deeply as the arms are raised.

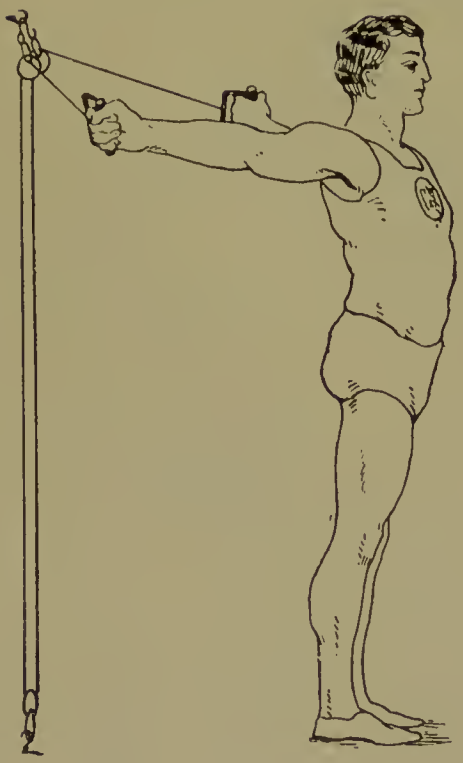


3.—Pectoral, Deltoid, Triceps, Serratus Magnus (Striking Muscles).

Straighten arms to the front, reaching forward as far as possible without moving the body, and return.

Position. Back to the Exerciser.
Advance either foot and bend the knee.
Handle in each hand, palms downwards
Bend elbows so that each hand is on a level with the breast and close to each side.

Movement. Straighten the arms to the front, reaching forwards as far as possible without moving the body. Hands should be on a level with the shoulders and close together.
Return to original position.
Repeat movement.

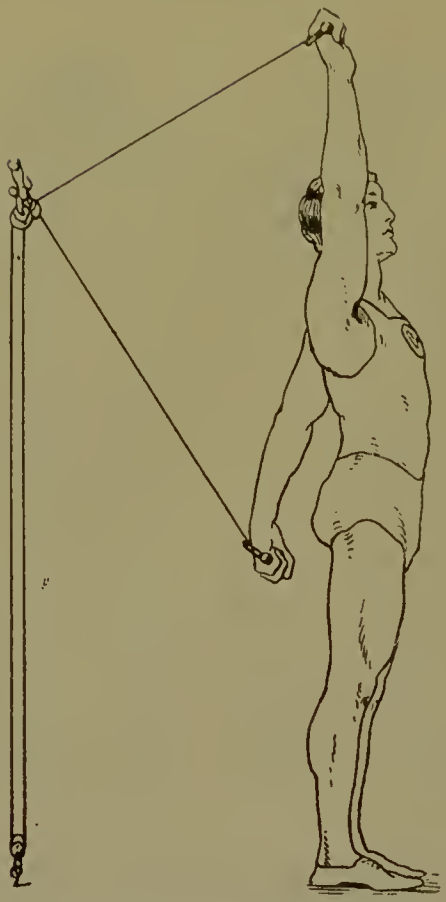


4.—Pectoral and Anterior Deltoid.

Carry both arms forward till hands meet in front, and return. Keep arms level with the shoulders, and elbows stiff, during the movement.

Position. Back to the Exerciser.
Advance either leg and bend the knee.
Handle in each hand, palms forwards.
Arms extended on a level with shoulders, and as far back as possible.

Movement. Circle the arms forwards at the level of the shoulders until the hands meet in front of the body.
Return to original position.
Keep elbows stiff throughout movement.
Repeat movement.



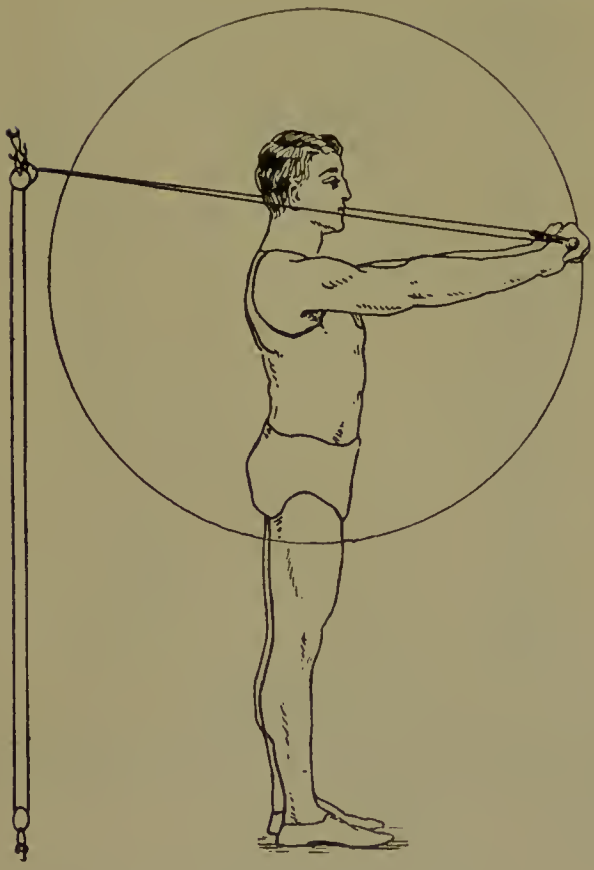
5.—Deltoid and Trapezius (Raise); Pectoral and Latissimus Dorsi (Depress).

Alternately move one arm up and the other down, keeping elbows stiff.

Position. Back to the Exerciser.
Advance either leg and bend the knee.
Handle in each hand, palms forward.
Arms fully extended, one up and the other down, on each side of the body.

Movement. Alternately circle forwards, one arm up and the other down.
Keep elbows stiff throughout movement.
Repeat movement.

A good Exercise for loosening the ligaments and tendons of the shoulder joint.

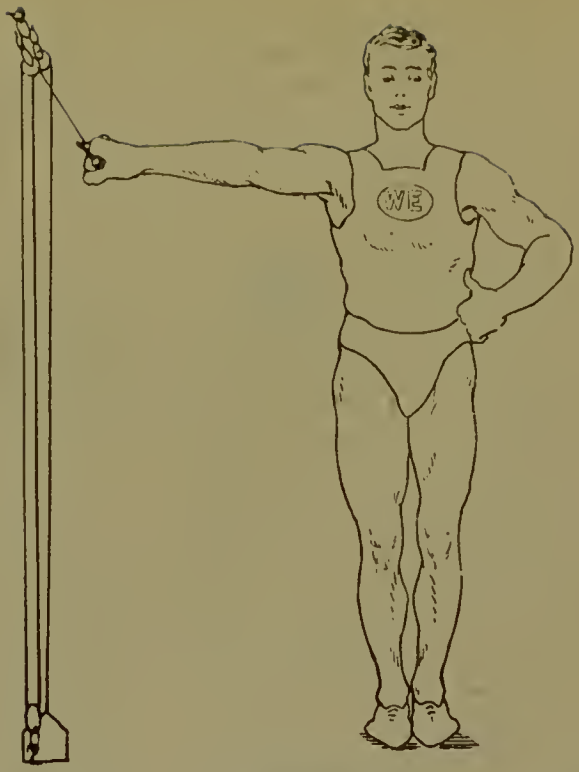


6. The Loosening of Ligaments and Tendons of Shoulder.

Circle both arms down, back up, and return to front. Keep elbows stiff.

Position. Back to the Exerciser.
Advance either foot and bend the knee.
Handle in each hand, palms downwards.
Arms fully extended to the front on a level with the shoulders.
Hands close together.

Movement. Circle both arms down, back, up, and return to front
Keep elbows stiff throughout movement.
Make as complete and large a circle as possible.
Repeat movement.



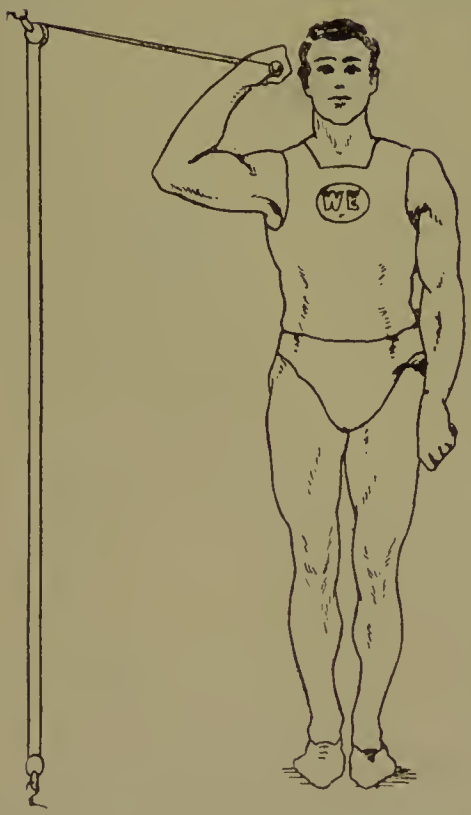
7.—(*a*) Pectoral. (*b*) Latissimus Dorsi. (*c*) Deltoid and Trapezius.

Stand with side to the Exerciser. (*a*) Carry arm down in front of body. (*b*) Carry arm down behind body. (*c*) Raise arm upwards to side of head. In each Exercise keep the elbows stiff, and return. Use each arm.

Position. Right side to the Exerciser.
Advance left leg to the side, and bend the knee.
One or both handles in the right hand, palms downwards.
Arm fully extended horizontally on a level with the shoulder.

Movement. (*a*) Circle the arm downwards and forwards to the front of the right hip (Pectoral).
(*b*) Circle the arm downwards and backwards to the back of the right hip (Latissimus Dorsi).
(*c*) Circle the arm upwards and inwards till the arm is perpendicular, and the hand straight over the head (Deltoid and Trapezius).
Return to original position and repeat.
Keep the elbow stiff and the body still throughout the movements.

These are three distinct Exercises, and should be practised separately. Use the left arm in each exercise by turning the left side to the Exerciser.

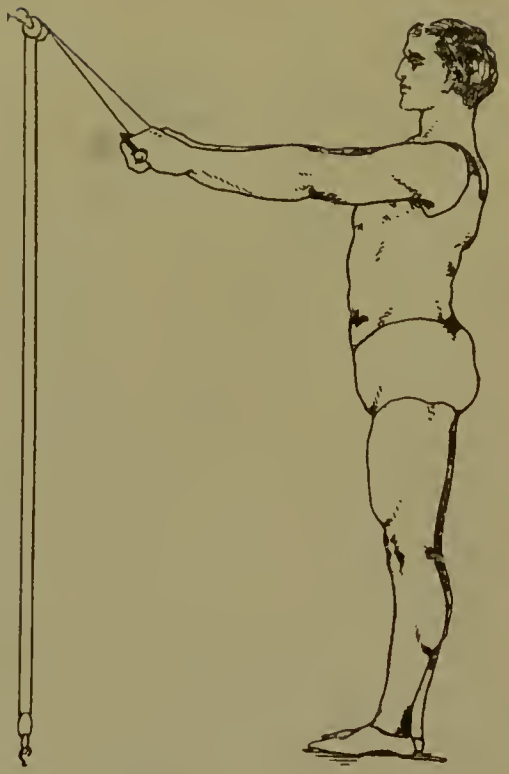


8.—Biceps and Flexors of Forearm.

Curl arm and wrist till hand nearly touches the shoulder. Use each arm.

Position. Right side to Exerciser.
Both handles in right hand.
Right arm fully extended horizontally outwards on a level with the shoulder.

Movement. Bend the elbow and wrist joint until the hand nearly touches the shoulder.
Keep body erect and steady.
Return to original position and repeat.
Use the other arm.



9. -(*a*) Triceps and Posterior Deltoid.
(*b*) Anterior Deltoid and Trapezius.

Face the Exerciser. (*a*) Carry arms down past the sides as far back as possible. (*b*) Carry arms straight up overhead. Keep elbows stiff in each exercise, and return.

Position. Face to the Exerciser.
Advance one leg and bend the knee.
Handle in each hand, palms downwards.
Arms fully extended horizontally forward on level with shoulders.

Movement. (*a*) Circle arms downwards and backwards to the side of the hips.
(*b*) Circle arms upwards and backwards to a perpendicular straight above the head.
Return to original position and repeat.
Keep elbows stiff throughout movement.

These are two distinct Exercises, and should be practised separately.

10. Erector Spinæ, Anterior Deltoid, Gluteus Maximus.

Bend the body forward, with knees stiff. Raise the body, and bend backwards as far as possible. At the same time, raise the arms above the head, with elbows stiff. Return.

Position. Face to the Exerciser.
Feet about six inches apart and level.
Handle in each hand, palms downwards.
Body bent forward, knees straight.
Arms fully extended downwards horizontally from shoulders.

Movement. Raise the body to an erect position. At the same time, raise the arms as far as possible straight above the head.
Carry the head and shoulders as far back as possible by bending the back.
Return to original position, and repeat.
Keep the knees and elbows stiff throughout the movement.

11. Biceps and Flexors of Forearm.

Curl both arms and wrists till hands nearly touch shoulders. Return.

Position. Face to the Exerciser.
Handle in each hand, palms upwards.
Arms fully extended horizontally forwards on a level with the shoulders.

Movement. Bend elbows and wrists until the hands nearly touch the shoulders.
Return to original position, and repeat.

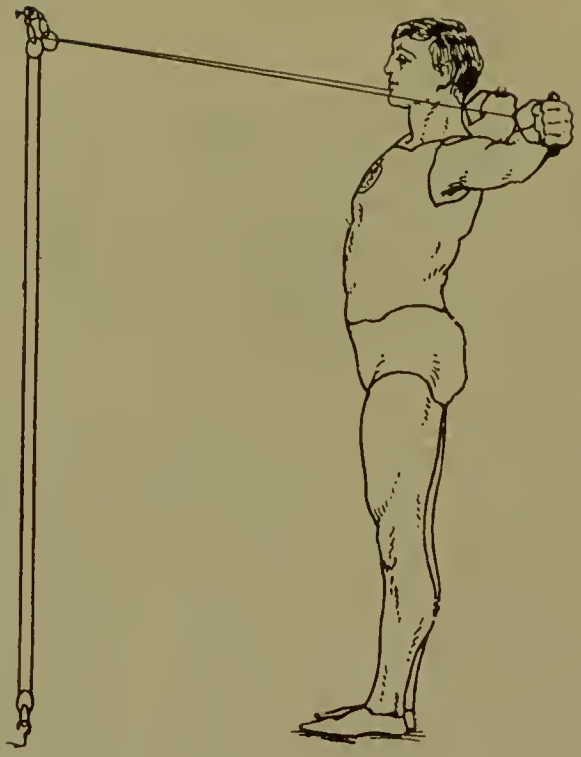
12.—Oblique Muscles of the Abdomen.

Swing both arms alternately to right and left. Keep arms on a level with shoulder.

Position. Face to the Exerciser.
Handle in each hand, palms inwards.
Arms fully extended horizontally forwards on a level with shoulders.

Movement. Swing both arms alternately to the right and left, at the same time let the body turn.

This Exercise is for the side muscles of the abdomen, and is a most useful movement for dyspeptics to make, as it causes a kind of massage of the bowels.



13.—Trapezius and Rhomboids.

From the front horizontal, carry arms straight back as far as possible, and return. Keep elbows stiff, and arms on level with the shoulder.

Position. Face to the Exerciser.
Advance one leg and bend the knee.
Incline the body forward.
Handle in each hand, palms inwards, knuckles touching.
Arms fully extended horizontally forwards on a level with the shoulders.

Movement. Circle arms outwards and backwards horizontally on a level with the shoulders.
Return to original position, and repeat.
Keep elbows stiff throughout movement and body still.

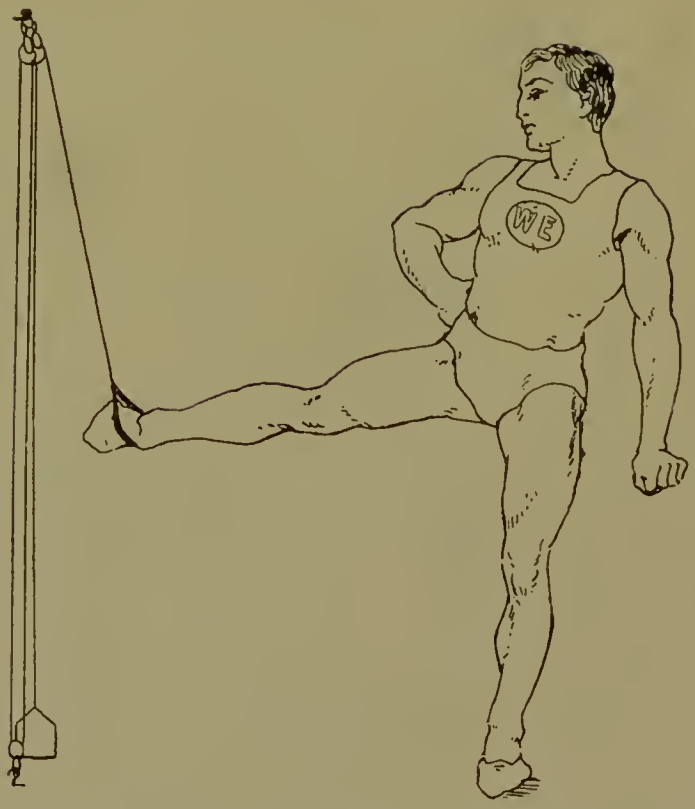
Keep the arms at a high level for the upper part of the Trapezius, and at a lower level for the middle part and the Rhomboids.

14.—Erector Spinæ, &c.

Same movement as in Exercise 10.

Position. Face to the Exerciser (handles at bottom).
Feet about six inches apart, and level.
Handle in each hand, palms downwards.
Body bent forward, knees straight.
Arms fully extended downwards horizontally from the shoulders.

Movement. Raise the body to an erect position. At the same time, raise the arms as far as possible straight above the head.
Carry the head and shoulders as far back as possible by bending the back.
Return to original position, and repeat.
Keep the knees and elbows stiff throughout the movement.



15. Adductor Magnus, Longus and Brevis, Pectineus, Sartorius (Adductors of Leg).

Bring leg down in front of opposite shin. Keep knee stiff, and return. Use each leg.

Position. Right side to the Exerciser.
Right foot attached to one or both handles, fully extended horizontally outwards from hip.
Keep the balance by holding on to a chair.
Body bent slightly sideways over the opposite leg, which is firmly planted upon the ground.

Movement. Circle the foot downwards and inwards towards the floor and across opposite shin.
Return to original position and repeat.
Keep the knee stiff throughout the movement.
Use the other leg.

16.—Biceps, &c. (Hamstrings).

Pull leg backwards, and bend knee. Use each leg.

Position. Face to the Exerciser (handles at bottom).
Right foot attached to one or both handles, leg fully extended downwards and slightly forwards.
Keep the balance by holding on to a chair.

Movement. Bend the knee by carrying the foot backwards and upwards.
Return to original position and repeat.
Use the other leg.

17. Quadriceps Extensor and Ilio-Psoas.

Pull leg forwards, and straighten knee. Use each leg.

Position. Back to the Exerciser (handles at bottom).
Right foot attached to one or both handles.
Leg extended downwards, and slightly backwards.
Knee slightly bent.
Keep the balance by holding on to a chair.

Movement. Circle the leg forwards and upwards, as high as possible, and straighten the knee.
Keep the other leg and body still.
Return to original position and repeat
Use the other leg.

18.—Gluteus Medius and Minimus (Abductors of Leg).

Pull leg outwards as high as possible. Use each leg.

Position. Right side to the Exerciser (handles at bottom).
Left foot attached to one or both handles.
Extended downwards but rotated outwards, with the knee slightly bent so that the calf crosses the knee of the other leg,
Keep the balance by holding on to a chair.

Movement. Circle the leg outwards and upwards as high as possible, and straighten the leg so that it is fully extended horizontally outwards from the hip.
Return to original position and repeat.
Keep the right leg and body still.
Use the other leg.

The Abdominal Muscles (a and b).

(*a*) Raise legs straight up to a perpendicular without bending the knees or ankles.

(*b*) Raise body to a sitting position.

(*c*) Keep body still, raise arms in a circle upwards, forwards, and downwards to sides of thighs.

(*d*) Circle arms outwards and downwards to side of thigh.

In each Exercise keep elbows stiff.

Position. Recumbent position — head towards Exerciser (handles at bottom).
Handle in each hand, palms upwards.
Arms fully extended perpendicularly straight above head.
Legs together, knees straight.

Movement. (*a*) Raise the legs to a vertical position, keeping knees and ankles fully extended. Lower the legs slowly.
(*b*) Raise the body to a sitting position, and lower again slowly. At the same time circle the arms upwards and forwards, keeping the elbows stiff.
(*c*) Circle the arms upwards, forwards and downwards, to side of thigh, keeping the elbows stiff and the body still.
(*d*) Circle the arms outwards and downwards to the sides of the thigh, keeping the elbows stiff and the body still.

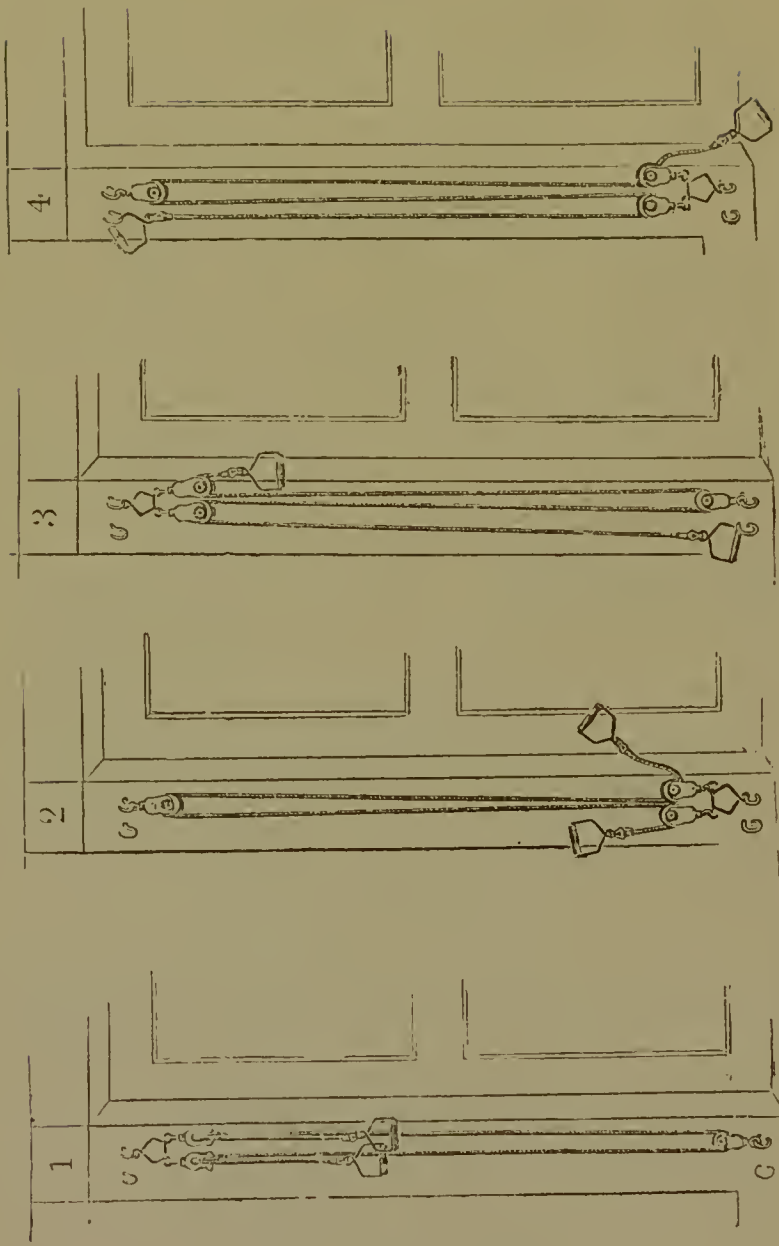
THE WHITELY SYSTEM

OF

PHYSICAL EXERCISE,

DESIGNED BY

ALEXANDER WHITELY.



DIFFERENT POSITIONS IN WHICH THE EXERCISER IS USED.

EXERCISE No. 1.—Throwing.

Suspend the apparatus as in position No. 3, grasp the handle with either hand, and make a movement exactly as though throwing a ball or light stone. Having tired the muscles on one side, change to the other, and repeat the movement until that side is tired, also.

This movement brings into play the muscles in front of the neck, the large muscles on the front of the chest, the muscles on the front and side of the abdomen, nearly all the muscles of the legs, and broadens the chest. Draw in the breath as you take the first position, and blow it out forcibly as you make the movement.

If the tension is not strong enough with one handle it may be doubled by taking both in one hand.

Before releasing your hold on the handles, relax the tension and give the cords time to untwist. If oiled the swivels will revolve without assistance.

EXERCISE No. 2.—Hoisting.

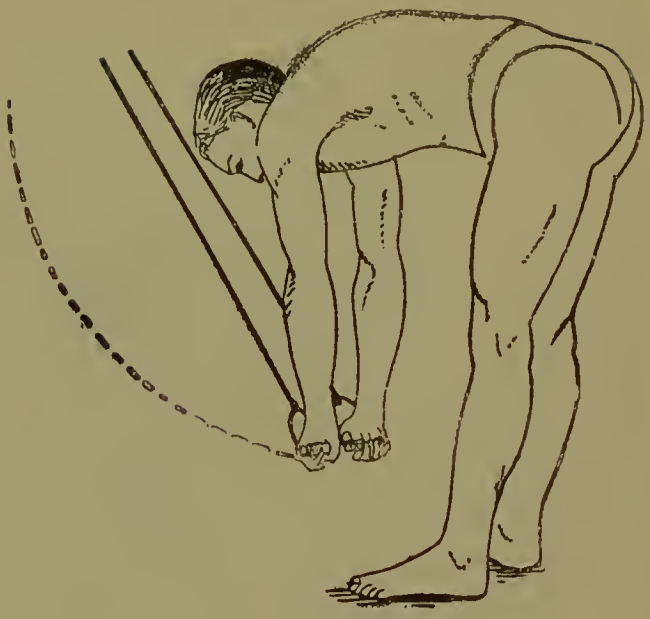
Take a handle in each hand and make a movement as though hoisting a bucket of pitch or gravel to the roof of a high building.

This exercise brings into action the muscles on the sides of the neck, muscles of the fore-arms, back arms, muscles of the back that draw the shoulders together, side muscles, and muscles on front of thighs. In making this movement, endeavour to send the "bucket" as high as possible at each sweep of the arm. In doing so, you will draw the arm back and around in a way that is necessary to develop the particular muscles which this movement is intended to reach.

Take in the breath as one hand is drawn dow and as the other comes down, expel it.

EXERCISE No. 3.—Hand-car.

With handles in each hand as before, make a movement as though working the lever of a hand-car,



pulling on an elevator rope, turning a crank, or a similar exercise.

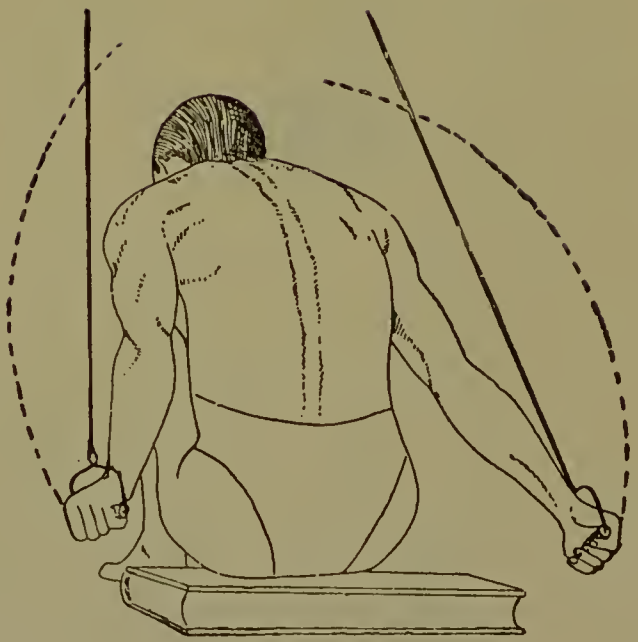
As you go up and back, draw in the breath deep and expel it forcibly as you go down. This exercise made more beneficial and agreeable by permitting t body to go a little further back than is indicated in t cut; but do not *pull* back; simply let the Exerci support you, while you let yourself go back as far comfortable.

This movement is particularly intended to rea the large muscles on the front of the chest a abdomen.

A stronger exercise for the same muscles is ma by turning the back to the Exerciser and making same movement.

EXERCISE No. 4.—*Swimming*

Exercises the muscles used in swimming or climbing; that is, the large muscles of the back that pull the arms downward and backward. This movement may be made sitting or standing. If made sitting, it is well to spread the knees as you draw the arms down,



and, as the arms go up, bring them together. This latter part of the movement exercises the muscles on the inside of the legs, which are much used in swimming. Draw in the breath as the arms go up and expel it as you draw them down.

This movement is a good chest expander.

EXERCISE No. 5.—Putting the Shot.

Shift the apparatus to position No. 4. Grasp the handle in one hand, and make a movement as though throwing a heavy stone or shot. Draw in the breath as you begin the movement, expel it as you finish When the muscles of one side are tired, change to the other and repeat the movement.

The exercise expands particularly the upper portion of the chest, exercises the fore-arm and biceps,

or front muscles of the upper arm, triceps, or ba
muscles of the upper arm, the upper portion of t
large muscles on front of the chest, and muscles
side of shoulder; also the side muscles of the boc
and nearly all the muscles of the legs and feet.

EXERCISE No. 6.—Rowing.

This movement may be made either sitting or standing, though it is better made sitting. Exerciser as in position No. 2. With a handle in each hand, make a movement as you would in rowing: as the body goes forward spread the knees, as represented in the first cut, and as you go back, bring them together as shown in the second.

The breath may be drawn in either as the body goes forward or backward, but as a rule, in any exercise, it is better to take the breath before the exertion. In this movement be careful to draw the arms and shoulders well back; for rowing, as it is generally performed with the sliding seat, tends to contract the front of the chest. The movement made as indicated in the cuts, or in rowing without the sliding seat, over-

comes that objection to the sport. In rowing, we u
the muscles of the forearm, legs, back muscles
the shoulders, nearly all the muscles of the back, a
the muscles of the back of the neck have considerab
to do. With the sliding seat, the muscles in front
the legs do much of the work, but as all the oth
movements exercise the legs, there would be nothi
gained in having the seat for this exercise. In fa
the development of the muscles on the inside of t
legs, as is done in the way the movement is sho
above, is much more to the point; for, with t
exception of exercise No. 4, these muscles have h
little work.

EXERCISE No. 7.—Drilling Stone.

With apparatus in position No. 4 grasp the handles with both hands, and make a movement as though drilling stone with a long drill, or lifting any weight above your head—jumping the baby, for instance.

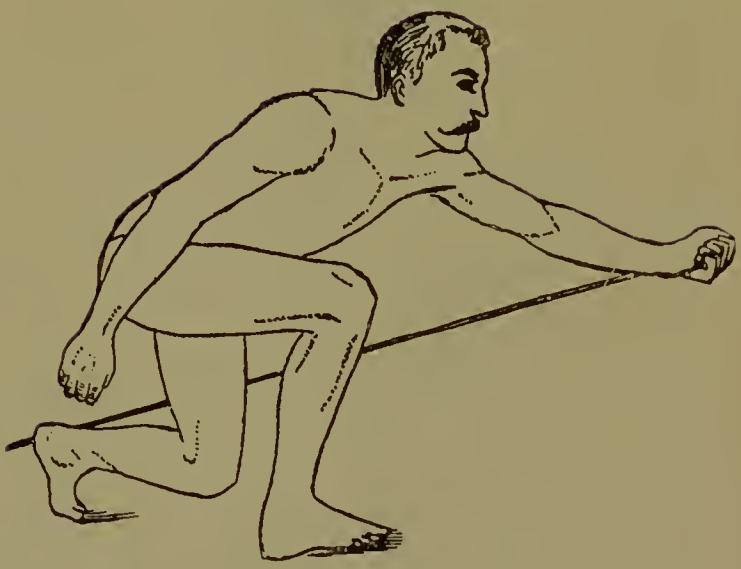
This exercise plays particularly on the front muscles of the shoulders, and some muscles in the back, and

is specially designed to lift the front walls of the ches and deepen it from front to back.

Inhale the breath fully as the arms ascend, a expel it forcibly as they descend.

EXERCISE No. 8.—Bowling.

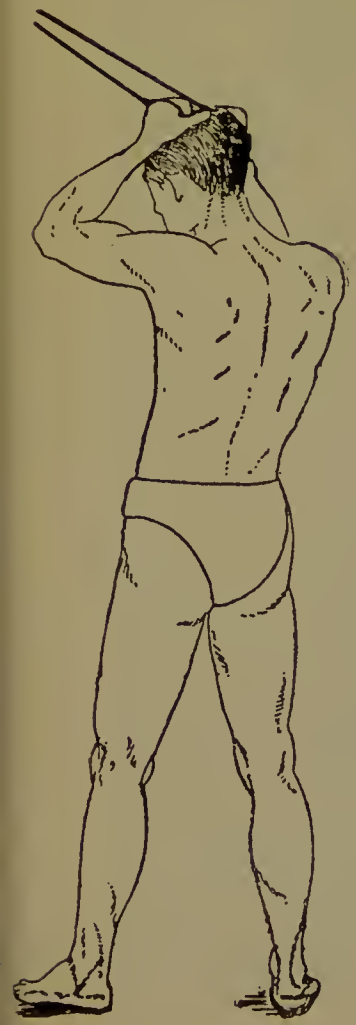
Suspend one handle again, and, with the other hand free, make a movement as though bowling, throwing



horse-shoes, quoits, or the ancient discus. Take breath as you prepare for the movement, and expel as you finish. This exercise is an unusually vigorou one, the greatest work falling upon the muscles of th fore-arm, front of the shoulder, and front and bac muscles of the thigh, though almost all the muscle of the body take part in it. When one shoulder tired, change to the other hand.

SPECIAL EXERCISES.

THE preceding exercises have pretty thoroughly exercised all parts of the body, but a few additional exercises are given to show that the apparatus may be used to develop any special part of the body independent of the rest



A special exercise for the back of the neck may be made by placing the handles on top of the head, and while holding them there with the hands, let the head go forward and compel the muscles to draw it back; repeat the movement until the muscles on the back of the neck begin to hurt. Be careful not to assist the movement with your arms, and to hold the rest of the body perfectly still.

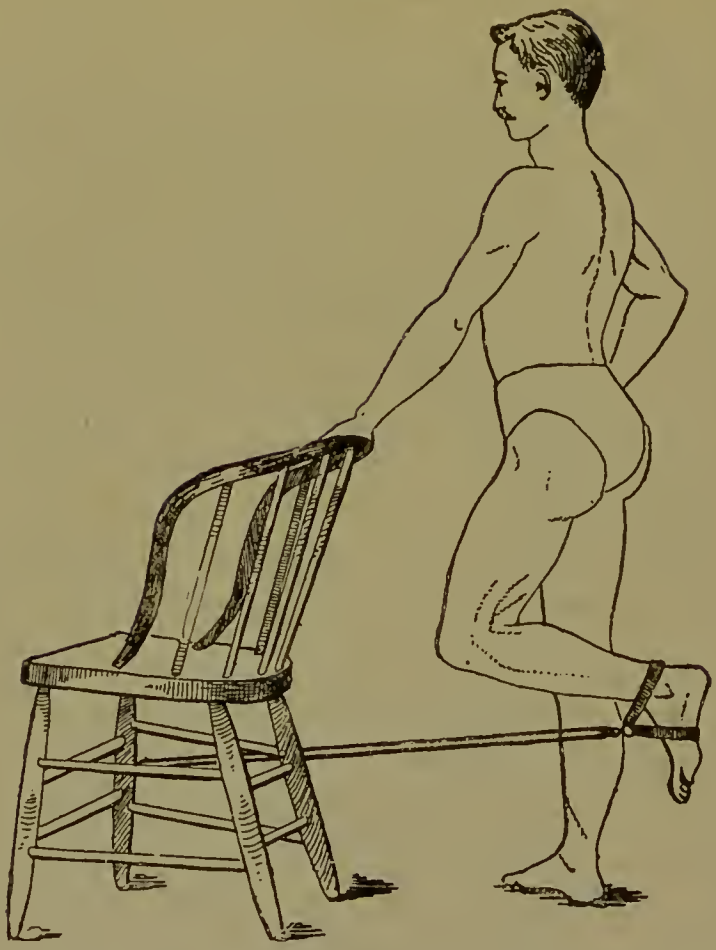
For the side of the neck, hold the handle or handl on top of the head, and compel the muscles to draw t head over toward the shoulder.

For the front muscles of the neck, simply reverse the movement given for the muscles of the back of the neck; or without using the Exerciser, let the head drop as far back as possible on the shoulders, and then bring it to an erect position. Continue the movement until the muscles of the front of the neck are tired.

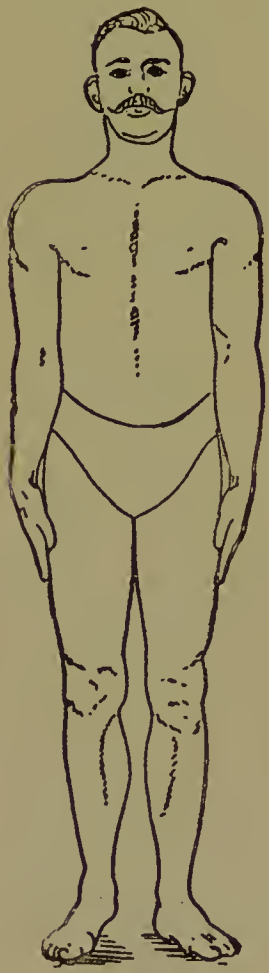
With the Exerciser suspended as in position No. 2, remove the lower handle, and instead, attach the foot strap by fitting the notch in the ring to the slot in the swivel at the end of the cord. Now, by inserting the foot in the straps and using a chair to sustain your equilibrium, you may exercise any special muscles of the legs you desire.

The exercise indicated in the opposite cut calls into action the biceps of the leg, muscles that, since running has gone out of fashion, are seldom used, but the development of which is needed if you would have shapely limbs.

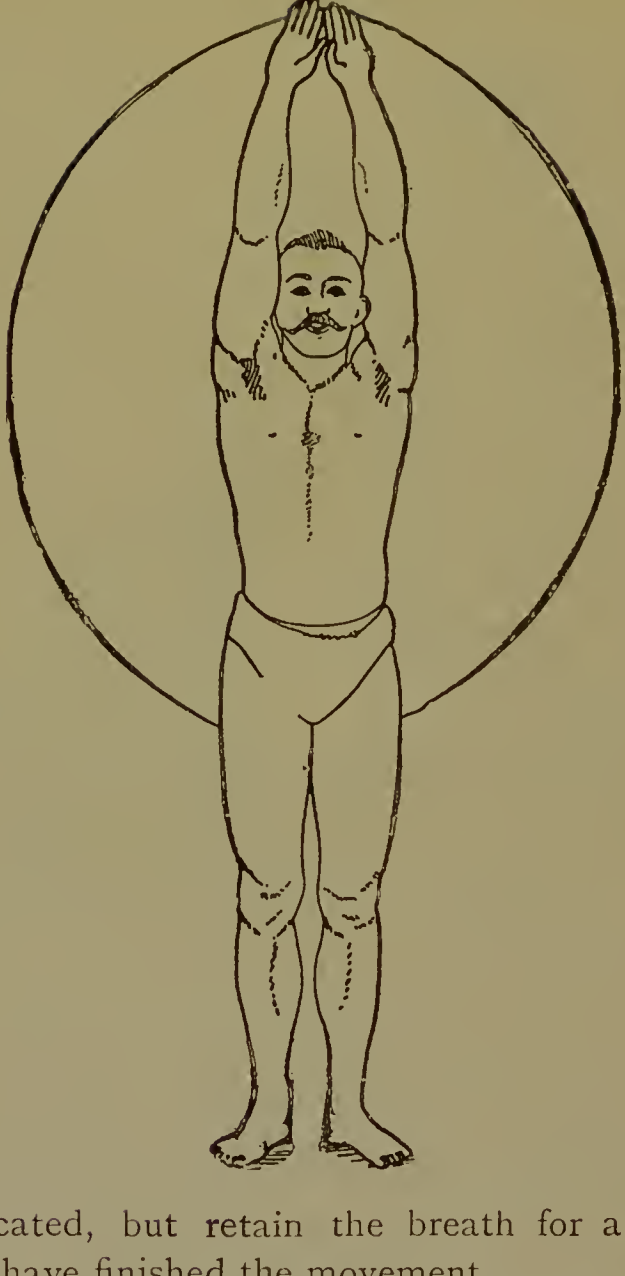
In devising special exercises, remember that muscles exert force by contracting only; that is, by drawing together or shortening; never by relaxing or lengthening. The general impression that the muscular back



of boxers implies great striking power is erroneous, for the muscles in the front of the body only are contracted in striking a blow, with the exception of the triceps or back muscles of the upper arm that are contracted to straighten it. The continual motion of the shoulders in bringing the arm back in striking accounts for some of this unusual development of the back of the shoulders in fighters; but the bulk of it is probably acquired through other exercises used in training.



As a finishing touch, this old-fashioned exercise for expanding the chest is given. From a position with the hands down at the sides, raise the arms laterally to a position high over your head, keeping the elbows straight. Inhale all the breath you possibly can as the arms go up ; bring the arms down again to the position



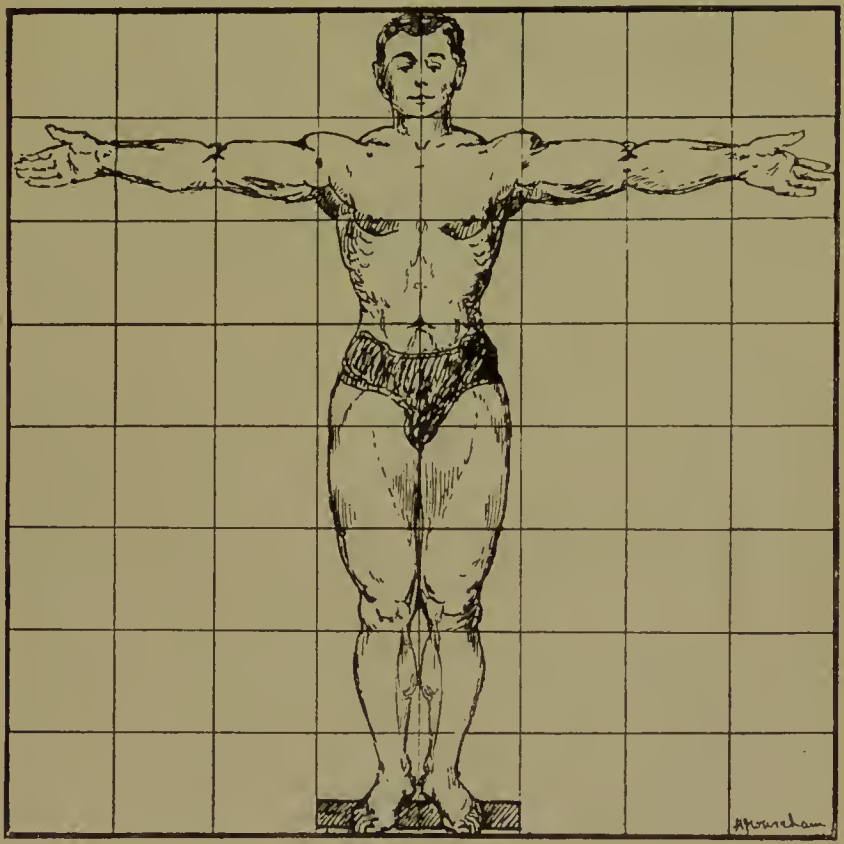
first indicated, but retain the breath for a moment after you have finished the movement.

The movement may be made stronger by taking a handle of the Exerciser in each hand, and keeping a light tension on the cords as the hands go up and down.

The Natural Laws of Human Proportions

IN BOTH SEXES.

By Dr. CHARLES ROCHET,
Sculptor, Painter, and Professor of Anthropology, Paris.



The Head.—Base of all the measures. Male, 9 inches; Female, 8½ inches.

The Man in a Square	8 measures of the Head, lengthwise and breadthwise.		
The Trunk	3	Lengths of the	Head.
The Thighs, including the Knees	2	do.	do.
The Legs, including the Feet	2	do.	do.
The Arms, giving with the part of the body to which they are affixed	4	do.	do.
The Man Sitting	4	do.	do.
The Man Kneeling	6	do.	do.

This is the product of 40 years' study of human nature, of measurements on individuals, and investigation in books.

The typical man, according to the above table, is 6 feet in height with the feet extended as in the figure; that is, with the heels raised 2½ inches.

Translated by O. Carter Blake, D.Sc.

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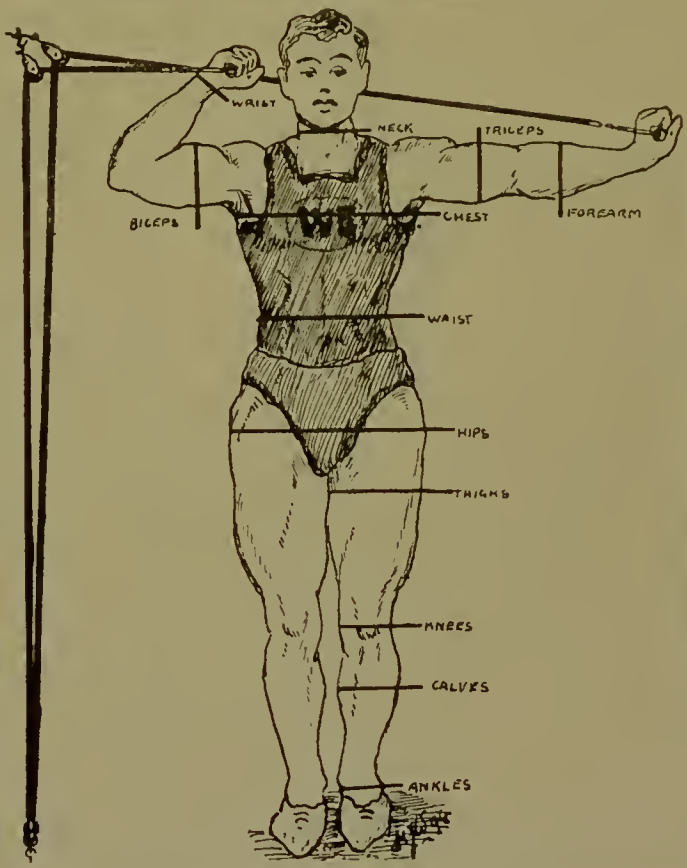
Showing how and where to take your own measurements.

Name_____ Age_____ Height _____



Take measurements every three months.

Date.	Neck.	Biceps.	Triceps.	Chest.	Forearm.	Wrist.	Waist.	Hips.	Thighs.	Knees.	Calf.	Ankles.	Weight.

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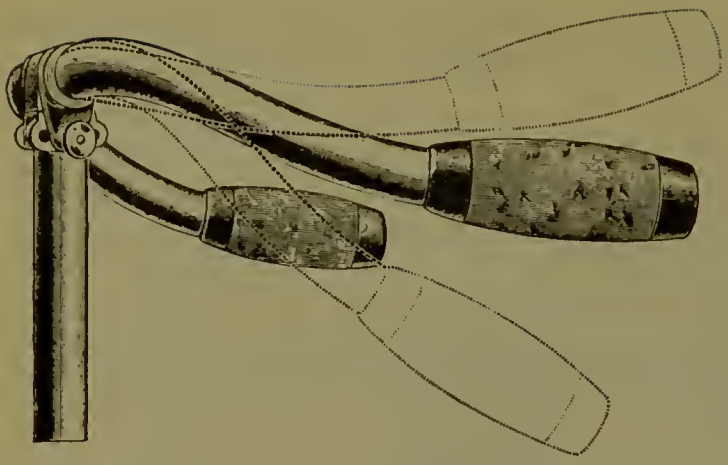

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